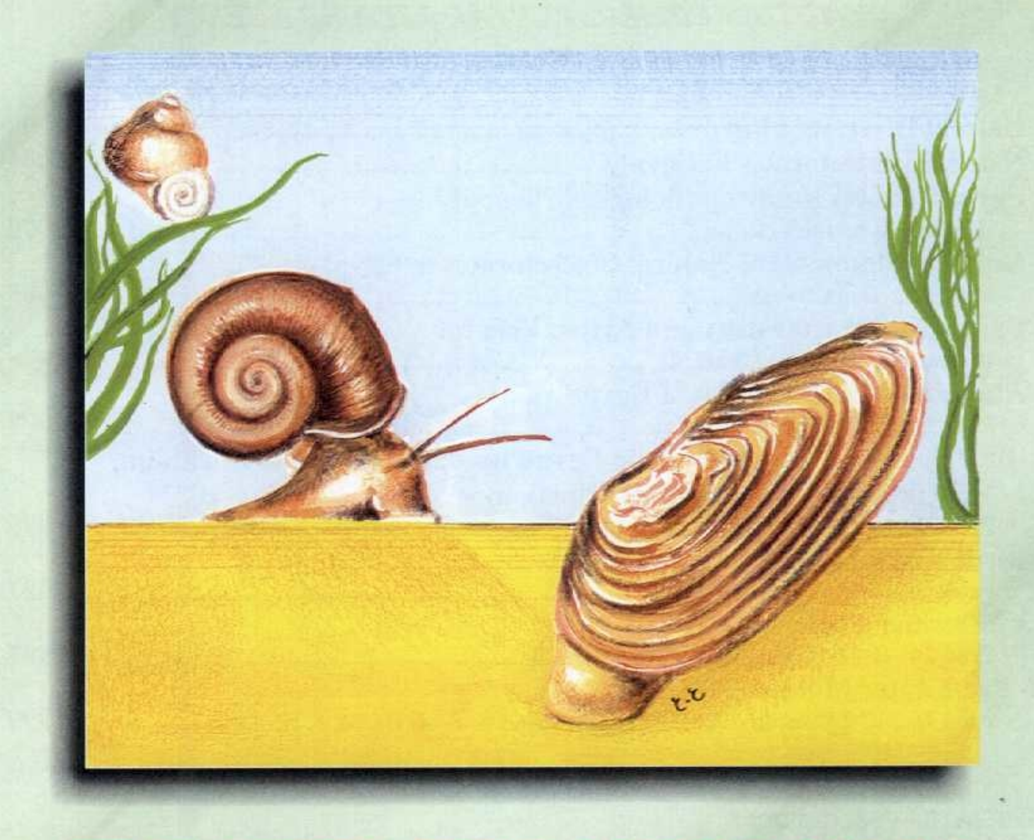
ARAB REPUBLIC OF EGYPT
CABINET OF MINISTERS
EGYPTIAN ENVIRONMENTAL AFFAIRS AGENCY ( EEAA)
DEPARTMENT OF NATURE PROTECTION



# FRESHWATER MOLLUSCS OF EGYPT


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**Publication of National Biodiversity Unit, No. 10, 1999**

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## *NATIONAL BIODIVERSITY UNIT*
## *EGYPTIAN ENVIRONMENTAL AFFAIRS AGENCY*
## *(EEAA)*

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**3- Egypt Country Study on Biological Diversity**
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# LANDSAT SATELLITE IMAGE OF THE ARAB REPUBLIC OF EGYPT FROM 950 Km ALTITUDE

# صورة فضائية لجمهورية مصر العربية من القمر الصناعى «لاندسات» من إرتفاع ٩٥٠ كيلو متر



First Published 1999

## *DEDICATION*

To

## *PROF. M. A. KASSAS*

**THE PIONEER IN ECOLOGICAL SCIENCES FOR HIS INSPIRATION IN ISSUING THE INVALUABLE SERIES ON BIODIVERSITY OF EGYPT.**

## ACKNOWLEDGMENT

The authors would like to express their thanks and gratitude to ***HER EXCELLENCY DR. NADIA MAKRAM EBEID,*** Minister of State for Environmental Affairs, for her interest and full support in the preparation of this book; and others of the Biodiversity series which will be an outstanding contribution to Biodiversity of Egypt.

We are particularly grateful to ***DR. MOHAMMED A. KASSAS***, Professor Emeritus of Botany and Applied Ecology, Cairo University for his interest, continuous encouragement and guidance. Without his inspiration and unyielding efforts, the present publication could not be completed. Also they extend their gratitude to ***DR. F. YOUSIF,*** Professor Emeritus , Medical Malacology Department, Theodor Bilharz Research Institute, Cairo, for his sincere help and cooperation.

The authors are grateful to ***DR. IBRAHIM ABDEL GALIL*** Chief Officer of the Egyptian Environmental Affairs Agency (EEAA) who has given the present publication his full support, and to ***PROF.DR.ESSAM EL BADRY,*** Director of the Nature Protection Department and Head of the National Biodiversity Unit (NBU) for his cooperation and help. The continuous efforts of ***MR. MOHAMMED IBRAHIM*** Deputy Director, Nature Protection Department is highly appreciated.

Our thanks are also due to ***DR. HASSAN KHASHABA*** for his patience and skill in typing and arranging figures for final form.

# FOREWORD

The interest in molluscs dates back to the Ancient Egyptians who were fascinated with their colours and variability. Later, in recent times, scientists began to study **Freshwater Molluscs of Egypt** associated with the Nile and its canals, especially certain species of snails which play an important role in transmitting diseases to man and his livestock, causing great loss of the national income.

Complete eradication of pest snails is impossible for biological purposes. Nevertheless, thorough application of anti-snail measures at regular intervals can reduce the snail population, thus decreasing the incidence of infection. Any snail control campaign necessitates identification of snails, determination of their potentiality as vectors of diseases and the extent of their distribution.

Our knowledge of the various freshwater molluscs is rather scanty, especially for those species of no apparent medical importance. Many of the species have numerous subspecies or varieties. For research workers, it is difficult to find out a single reference or a manual key, and they have to consult many references before finding the correct identification. Even though, some of the questions on systematics of many species remain to be solved. Furthermore, knowledge of existing species will enable malacologists to register new species in addition to the introduced ones.

The authors of this particular welcome reference ***(PROF. A. IBRAHIM, PROF. H. BISHAI AND PROF. M. KHALIL)*** undertook the responsibility of revising and identifying the various freshwater molluscs occurring in Egypt either through thorough field collection for many years or records from the literature. In this reference book, they laid the basis of simple ways for identification of various species through simple keys. Their effort is considered the only consolidated study in the field of Medical Malacology so far in Egypt. Cordial thanks to the authors for their effort and valuable contribution.

Being one of the publications of the ***National Biodiversity Unit, Egyptian Environmental Affairs Agency***, it is a most welcome addition to the series of which nine volumes are issued. This series is meant for sound identification of the various local species, their conservation and utilization.

*Nadia Makram Ebeid*

MINISTER OF STATE FOR ENVIRONMENTAL AFFAIRS

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# INTRODUCTION

Freshwater molluscs in Egypt have been studied over a long time, but most malacologists paid special attention to the principal snail groups which transmit Schistosomiasis to man such as *Bulinus* spp. and *Biomphalaria* spp. as well as *Lymnaea* spp., which transmit fascioliasis (liver fluke) to cattle, sheep and also man, as has been recently discovered. The least studied group of gastropods is the prosobranch snails, where most of them have no prominent medical or veterinary importance. However, they play an important role in the freshwater ecosystems and some of their local members were recently incriminated in transmitting serious human diseases.

On the other hand, freshwater bivalves occurring in Egypt represent a neglected animal group and little is known about them or their diversity, perhaps due to the fact that they have no economic or medical importance. Generally, most bivalves, especially unionids, possess a great ecological adaptability, which often finds expression in the shape of the shell. Such ecotypes are well known in European and African unionids, that most of them have so variable shell morphology leading to confused nomenclature and classification. This variation, coupled with the relatively few constant characters, have rendered the Bivalvia a systematically difficult group for almost a life time. Therefore, much more material should be collected and studied, and a taxonomical revision for some of the species, became desirable and essential.

The present issue is a trial to reexamine, as much as possible, all freshwater molluscs occurring in Egypt at present, and to report on their biodiversity, taxonomy, morphology (mainly on shell), and geographical distribution. The major part of the material on which the present study is based was collected during 1994 and covered 23 governorates, most of which are located along the River Nile system and its tributaries; from Upper Egypt to Delta. Records from the literature are quoted only in cases where no specimens from the respective localities have been available.

In each governorate, many sampling sites were chosen to represent various water bodies (main River Nile, canals, streams and drains) as much as possible. Sampling was carried out monthly, using a long-handled dip net for shallow sites and banks where water weeds were plentiful, while in deep sites Ekman dredge was used.

In Egypt, 37 gastropod species have been recorded, of which 13 species are operculated and belong to 7 families and 9 genera, and 24 species are non-operculated and belong to 5 families and 11 genera. Out of the 37 species; 16 have been found as common, 18 are rare and 3 extinct.

On the other hand, 36 freshwater bivalves have been recorded in the River Nile and its tributaries. They belong to 5 families and 9 genera. 15 species have been recorded as common ones, 11 are considered rare species and 10 species extinct.

*THE AUTHORS*

## Historical review

The first specimens of African freshwater molluscs were collected in Senegal by the French naturalist Michel Adanson during his self-financed expedition from 1747 until 1752 (Van Damme, 1988). Around the same time, James Bruce reported the first specimens of freshwater molluscs along the River Nile during his expedition to discover the source of the Nile in the period between 1768 to 1773. He mentioned that he had seen at Sennar (Sudan) large green snails, almost a pound in weight (probably *Pila wernei*) and mussels (probably *Spathopsis*) in the middle of the Nubian desert (Van Damme, 1988). The French malacologist Olivier (1804) had recorded five species of freshwater snails from Lower Egypt. During Napoleon's subsequent campaign to Egypt (1798-1801), the accompanied swarm of naturalists collected the local fauna as well as flora, and Savigny (1809) had recorded the molluscan species (in Description de l'Egypte, 1809). The first collections and descriptions of molluscs from the Nile south of the First Cataract were, however, made somewhat later by the French adventurer-naturalist Cailliaud (1826). He followed the Nile as far as Sennar in Sudan with a Turko-Egyptian punitive expedition. After Cailliaud, the urge to discover the sources of the Nile became obsessive, and expedition after expedition set off from Cairo at a pace of about one every five years. The contribution to malacology by these expeditions was, however, minimal. It was only in 1874 that the collections and description of Jickeli in Lower Egypt and Ethiopia led to the first comprehensive monograph on freshwater molluscs of North East Africa. Bourguignat (1890) practically held a monopoly on all the African material that was brought to France.

Pallary (1909 and 1924) described several species of freshwater molluscs (gastropods and pelecypods) from Egypt and some African countries and illustrated their characters in a valuable monograph. Leiper (1916) found some snails namely *Planorbis boissyi, Bulinus dybowskii* and *Lanistes bolteni* occurring in canals and ditches round El-Marg, Cairo. He collected also *Bulinus contortus, Bulinus dybowskii, Lymnaea cailliaudi* and *Cleopatra bulimoides* from ponds at the Zoological Garden of Giza. Furthermore, he collected *Melanoides tuberculata* from a marshy land on the desert side of Ismailiah Canal south of Belbis.

Connolly (1931) claimed that *Lymnaea cailliaudi* is widely distributed in Egypt. Gardener (1932) described and discussed the whole molluscan fauna of Fayoum depression, and he paid special attention to the problem of shell variation and their causes. Scott during his investigation in Egypt in 1937, stated that *Planorbis boissyi* does not occur in Upper Egypt except in a small region on the west side of the Nile as far south as Cairo (Van

Damme, 1988). Piersanti (1940) gave a preliminary list of Mollusca of Lake Tana, but this list has been corrected and revised by Bacci (1951 and 1952).

On the other hand, Mandahl-Barth (1954) studied the freshwater molluscs in Uganda and adjacent territories and listed 126 species (86 gastropods and 40 bivalves). Moreover, he recorded 65 species and subspecies in Lake Victoria and 75 species in Zambia; 49 belong to Gastropoda and 26 to Bivalvia (Mandahl-Barth, 1968).

El-Gindy (1957) after studying the distribution of *Biomphalaria boissyi, Bulinus truncatus* and *Pyrgophysa forskalii* in Egypt, pointed out that the southern part of Delta enclosed between the Nile branches together with two corresponding stripes of land outside the branches were ground free of *Bulinus boissyi*. El-Gindy (1957) reported that *Bulinus truncatus* was widely distributed all over the irrigated area of the country. He also collected *Bulinus forskalii* from several canals and ditches in Behaira, Qaliubyia, Giza, Beni-Suef and Qena governorates.

Detailed studies on the morphology and biology of the planorbids of Egypt were carried out by Demian (1957 and 1960). He described thoroughly the shell morphology and macroscopic anatomy of *Bulinus (Bulinus) truncatus, Bulinus (Bulinus) forskalii, Biomphalaria boissyi, Planorbis philippi* and *Gyraulus mareoticus*. Depending on both conchological and anatomical features, Demian concluded that *Bulinus truncatus* Audouin, 1826; *Bulinus contortus* Michaud, 1829, *Bulinus dybowski* Fischer, 1891 and *Bulinus innesi* Pallary, 1909 were just variations of one and the same species namely *Bulinus truncatus* Audouin, 1826.

Brown (1965) studied the anatomy and distribution of gastropod molluscs from a variety of freshwater habitats in Ethiopia. Williams and Hunter (1968) carried out a detailed study on the distribution of *Bulinus* and *Biomphalaria* in mid-Sudan during 1968 (Van Damme, 1988)

Monakov (1969) carried out quantitative investigations on the benthos of the Nile and studied the benthic organisms of the White Nile and adjoining waters in the Republic of Sudan. Berrie (1970) discussed the geographic distribution of the genus *Bulinus* and the role of the Nile as a link between the species of the North and South of the Sahara.

Ishak *et al.* (1976 and 1979) performed quantitative studies on the benthic fauna of the River Nile from Assuit to Rosetta and Damietta branches through a project of water quality studies on the River and Lake Nasser. Abdel-Aal (1979) studied the seasonal variations of gastropod molluscs in the Damietta Nile branch near El-Mansoura.

Brown (1980) studied the freshwater snails of Africa and their medical importance, ecology, distribution and parasites. Brown (1983)

published a field guide to African Freshwater Snails in Eastern Mediterranean Region including Egypt through WHO support. Brown *et al.*(1984) gave an account of the aquatic gastropod molluscs in the Sudd region of Southern Sudan and they recorded about 23 species of aquatic snails of which a number serve as intermediate hosts for trematode parasites. Barsoum (1987) collected 16 species of freshwater snails, 7 prosobranchs and 9 pulmonates from some localities along the River Nile.

Van Damme (1984 & 1988) studied the freshwater molluscs of Northern Africa, their distribution, biogeography, evolution and palaeoecology. Burch (1985) gave a detailed account on the snail-mediated diseases in Jordan. Iskaros (1988) investigated the bottom fauna of Lake Nasser and adjacent waters and recorded 9 gastropods and only 2 bivalves. Mandahl-Barth (1988) studied the freshwater bivalves for about thirty years in African countries, including Egypt. He recorded his experience in a valuable paper entitled "Studies on African Freshwater Bivalves" which included the description, taxonomy and geographic distribution of many bivalves in different African countries.

Menshawy (1998), together with the first and third authors of this issue, conducted a thorough survey on the freshwater molluscs in the Egyptian irrigation system. They recorded about 20 gastropod species and 23 bivalves.

## CLASS GASTROPODA

The Gastropoda is the largest molluscan group, including marine, freshwater and terrestrial forms, living under different sorts of environmental conditions. It comprises about 300 living families and nearly 100 extinct families (Clarke, 1973). Most species possess spiral shells but some have limpet-shaped shells and others (slugs and nudibranchs) are without shells. The mouth in most groups is fitted with a chitinous plate (the jaw) and with a radula. The radula is a ribbon-like structure, bearing numerous transverse rows of minute chitinous teeth used principally for rasping food. It rests on a cartilagenous pad called odontophore.

The Gastropoda is divided into three subclasses, one of which the Opisthobranchia is almost exclusively marine. The other two, namely the Prosobranchia and the Pulmonata, are well represented in freshwater ecosystems all over Egypt.

### 1- Identification Key for Freshwater Gastropod Families

The two freshwater gastropod subclasses can be differentiated from each other by:

A. Presence of the operculum, sexes are separate, radula has 7 teeth in each transverse row .................................................................... **Prosobranchia**

B. Absence of the operculum, hermaphrodites, radula with numerous teeth in each row .......................................................................... **Pulmonata**

### A- Subclass PROSOBRANCHIA (with operculate shell)

1- Shell is hemispherical, consisting of few whorls, and the spire is small. Operculum with apophyses and the shell is dextral .............. .**Neritidae**

2- Shell is conical, no sculpture. Operculum is concentric and the shell is dextral ........................................................................................ **Viviparidae**

3- Shell is somewhat globose, large and sinistral or dextral. Full-grown shell is more than 15 mm high. Operculum is calcareous and concentric.............................................................................. **Ampullariidae**

4- Full grown shell is less than 10 mm high. Shell is wider than high and dextral. Aperture is circular and the operculum is multispiral ......................................................................................................... **Valvatidae**

5- Full-grown shell is less than 15 mm high. Operculum is calcified, oval, with a spiral nucleus and the shell is dextral ........................ **Bithyniidae**

6- Operculum is concentric with a spiral nucleus or paucispiral and the shell is dextral ................................................................................ **Thiaridae**

7- Shell is small; less than 5 mm high. Operculum is corneous and spirally built ........................................................................... **Hydrobiidae**

**B- Subclass PULMONATA (with non-operculate shell)**

1-Shell is spirally coiled, globose, ovate or elongate dextral ... **Lymnaeidae**

2- Shell is elongate, ovate, dextral, with a short spire, blunt and not umbilicated ................................................................................ **Succineidae**

3- Shell may be spirally coiled (sinistral) or discoid .................. **Planorbidae**

4- Shell is glossy, sinistral with an acute apex .................................. **Physidae**

5- Shell is cap-shaped ...................................................................... **Ancylidae**

**Checklist and Status of Freshwater Gastropods in Egypt**

| Species | Status | | |
|---|---|---|---|
| | Common | Rare | Extinct |
| **A- SUBCLASS PROSOBRANCHIA** | | | |
| **Family: Neritidae** | | | |
| 1-*Theodoxus* (*Neritaea*) *niloticus* (Reeve, 1856) | * | | |
| **Family: Viviparidae** | | | |
| 2-*Bellamya unicolor* (Olivier, 1804) | * | | |
| **Ampullariidae (Pilidae)** | | | |
| 3-*Lanistes carinatus* (Olivier, 1804) | * | | |
| 4- *Lanistes varicus* (Müller, 1774) | | * | |
| 5- *Pila ovata* (Olivier, 1804) | | * | |
| 6-*Pila wernei* (Philippi, 1851) | | | * |
| **Family: Valvatidae** | | | |
| 7-*Valvata nilotica* Jickeli, 1874 | * | | |
| **Family: Bithyniidae** | | | |
| 8-*Gabbiella senaariensis* (Küster, 1852) | * | | |
| **Family: Thiaridae (Melaniidae)** | | | |
| 9-*Melanoides tuberculata* (Müller, 1774) | * | | |
| 10-*Cleopatra bulimoides* (Olivier, 1804) | * | | |
| **Family: Hydrobiidae** | | | |
| 11- *Hydrobia aponensis* Martens, 1874 | | | * |
| 12- *Hydrobia musaensis* (Frauenfeld, 1855) | * | | |
| 13- *Hydrobia ventrosa* (Montagu, 1803) | * | | |
| **B- SUBCLASS PULMONATA** | | | |
| **Family: Lymnaeidae** | | | |
| 14- *Lymnaea natalensis* Krauss, 1848 | * | | |
| 15- *Lymnaea columella* (Say, 1817) | | * | |
| 16- *Lymnaea stagnalis* (Linnaeus, 1758) | | * | |
| 17- *Lymnaea peregra* (Müller, 1774) | | * | |

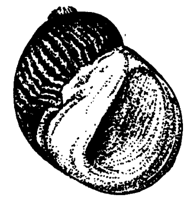
| Species | Status | | |
|---|---|---|---|
| | Common | Rare | Extinct |
| 18-*Lymnaea auricularia* (Linnaeus, 1758) | | * | |
| 19- *Lymnaea (Galba) truncatula* (Müller, 1774) | | * | |
| 20- *Lymnaea* (*Stagnicola*) *palustris* (Müller, 1774) | | | * |
| **Family: Succineidae** | | | |
| 21-*Succinea* (*Amphibina*) *cleopatra* (Pallary, 1909)+ | * | | |
| **Family: Planorbidae** | | | |
| 22-*Planorbis planorbis* (Linnaeus, 1758) | * | | |
| 23- *Afrogyrus oasiensis* (Demian, 1962)+ | | * | |
| 24- *Afrogyrus coretus* (Blainville, 1826) | | * | |
| 25-*Gyraulus ehrenbergi* (Beck, 1837)+ | * | | |
| 26-*Segmentorbis angustus* (Jickeli, 1874) | | * | |
| 27-*Helisoma duryi* (Wetherby, 1879) | | * | |
| 28-*Biomphalaria alexandrina* (Ehrenberg, 1831) | * | | |
| 29-*Biomphalaria pfeifferi* (Krauss, 1848). | | * | |
| 30-*Biomphalaria glabrata* (Say, 1818). | | * | |
| 31- *Bulinus* (*Bulinus*) *forskalii* (Ehrenberg, 1831). | | * | |
| 32- *Bulinus* (*Isidora*) *truncatus* (Audouin, 1827). | * | | |
| 33- *Bulinus* (*Isidora*) *guernei* (Dautizenberg, 1890). | | * | |
| 34- *Bulinus* (*Isidora*) *natalensis* (Küster, 1841). | | * | |
| **Family: Physidae** | | | |
| 35-*Physa acuta* Draparnaud, 1805 | * | | |
| **Family: Ancylidae** | | | |
| 36- *Ferrissia isseli* (Bourguignat, 1866) | | * | |
| 37- *Ferrissia clessiniana* (Jickeli, 1882)+ | | * | |
| Total number of species | 16 | 18 | 3 |

+ Endemic species

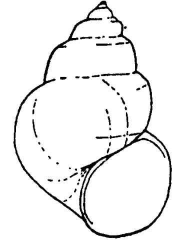
| Family | Vector Snail | Parasite |
|---|---|---|
| **Planorbidae** | *Bulinus truncatus*<br>*Bulinus forskalii* | *Schistosoma haematobium*<br>*S. intercalatum*<br>*S. bovis*<br>*Paramphistomum microbothrium*<br>**(Stomach fluke)** |
| **Planorbidae** | *Biomphalaria alexandrina*<br>*B. pfeifferi*<br>*B. glabrata*<br>**Hybrid of** *B. glabrata* **and** *B. alexandrina* | *Schistosoma mansoni* |
| **Lymnaeidae** | *Lymnaea natalensis*<br>*L. columella*<br>*L. truncatula*<br>*L. stagnalis* | *Fasciola gigantica*<br>*F. hepatica* **(Liver fluke)** |
| **Thiaridae** | *Cleopatra bulimoides* | *Gastrodiscus aegypticus*<br>*Prohemistomum vivax* |
| **Thiaridae** | *Melanoides tuberculata* | *Lecithodendrium pyramidum* |
| **Ampullariidae** | *Lanistes carinatus* | *Cercaria pusilla*<br>*Angiosrongylus cantonensis*<br>**(Rat-lung nematode)** |
| **Viviparidae** | *Bellamya unicolor* | |

# A PICTORIAL INDEX TO FAMILIES

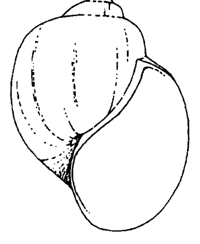
## PROSOBRANCHIA



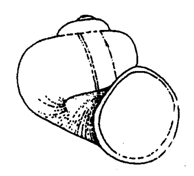
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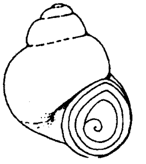
Viviparidae



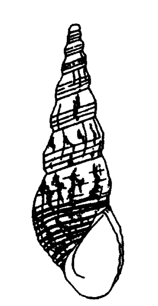
Ampullariidae (Pilidae)



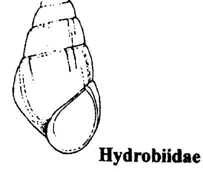
Valvatidae



Bithyniidae



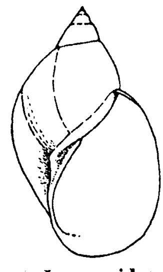
Thiaridae (Melaniidae)



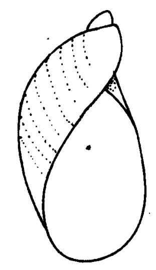
Hydrobiidae

# A PICTORIAL INDEX TO FAMILIES

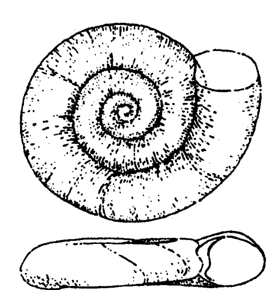
## PULMONATA



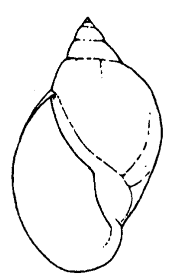
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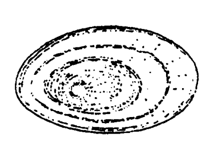
Succineidae



Planorbidae

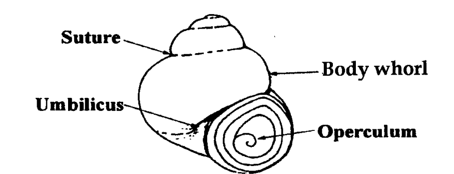


Physidae

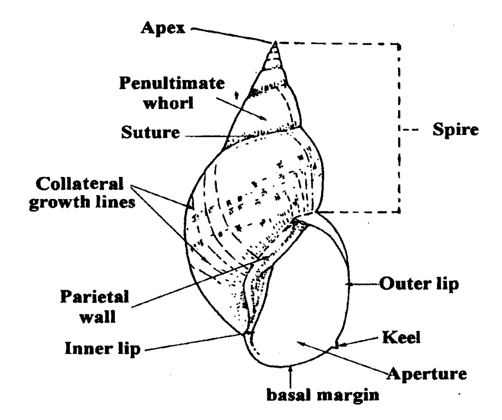


Ancylidae

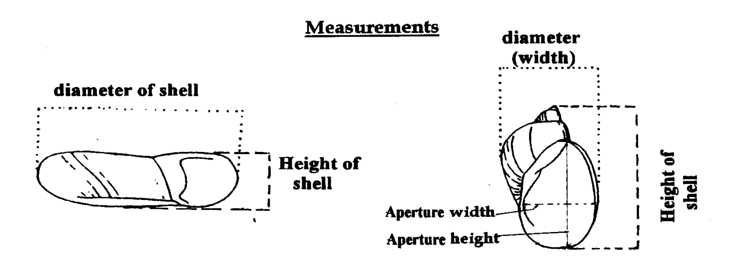
# TECHNICAL TERMS AND MEASUREMENTS




**Prosobranch gastropod shell**




**Pulmonate gastropod shell**



# A. SUBCLASS: PROSOBRANCHIA

Most prosobranchs possess an operculum, respire by ctenidia, have separate sexes and only one pair of tentacles.

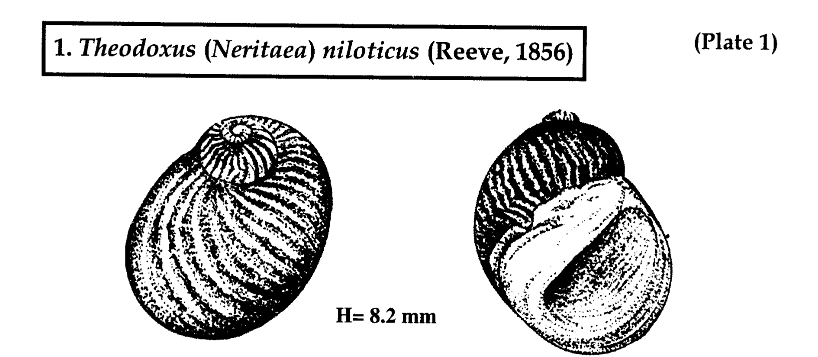
## FAMILY: NERITIDAE

Two genera with at least three species occur in the Mediterranean region. One genus, including one species occurs in Egypt. No species of medical importance.

### Genus: *Theodoxus* Montfort, 1810

The subgenus *Neritaea* is restricted to the lower Nile and reached Africa via Arabia. The systematics of *Theodoxus* is still unsettled because of polymorphic species.

### 1. *Theodoxus* (*Neritaea*) *niloticus* (Reeve, 1856) **(Plate 1)**




**Synonym**

*Neritina nilotica* Reeve, 1841.

**Description**

The shell is dextral, hemispherical, more or less conical with a tendency for elongation of the last whorl. It has the appearance of a truncated cone when viewed from its dorsal aspect, with a broad, rounded and oblique base and very short obtuse spire.

The shell has 3 spirally coiled whorls which are more rounded at the periphery and separated by a shallow suture. The aperture is semicircular to globose in outline. It takes exactly the shape of letter D. It is limited by an outer delicate lip sloping down at a very acute angle to the columella. The shell is not umbilicated, so the inner lip or columellar

margin is twisted. The operculum is a thin semi-ovate calcareous disc with apophyses on the inner surface.

The sculpture includes more or less wavy oblique axial stripes of varying thickness. The stripes may be broad and relatively few, or narrow and numerous, but in any one colony, the same kind of stripes is dominant. The broader striped form is the commoner. The amount of undulation in the striped form varies greatly, not only in one colony, but in one shell. Incipient zigzagging may be shown in the broad forms, but the extreme zigzagging with the narrowing is never found in broad-banded colonies. Growth lines are distinct.

**Colour:** The colour of the shell varies from black stripes on white or pale yellowish ground in the wavy striped variety, dark purple stripes, black in the spire to pink stripes.

**Size:** The average size is 9 (H) x 8 mm (D).

**Habitat**

It lives in all types of water bodies including stagnant or slowly flowing streams. It usually occurs in colonies on and under rocky limestone ledges near the shoreline, associated with many species of aquatic plants, such as *Potamogeton crispus, Ceratophyllum demersum* and *Myriophyllum spicatum*.

**Distribution**

**Local**: Along the River Nile and its tributaries from Lake Nasser (Upper Egypt) to Rosetta and Damietta branches (Lower Egypt).

**World**: In Ethiopia, it was recorded from the Blue Nile below Lake Tana (Bourguignat, 1883) and near Massawa (Bacci, 1951).

**Status:** Common.

## FAMILY: VIVIPARIDAE

Two genera occur in Africa, one (*Neothauma*) is endemic to Lake Tanganyika; the other (*Bellamya*) is found all over Africa (except in the north-west) and throughout southern and south-eastern Asia.

### Genus: *Bellamya* Jousseaume, 1886

Medium- sized to large (20-30 mm. high) dextral snails, with a corneus concentric operculum, conical spire and almost circular aperture. The female is viviparous, carrying developing young in the lower part of the oviduct.

This tropical genus is represented in Egypt by one extremely polymorphic species; *Bellamya unicolor*. The oldest known occurrence in Africa dates to the lower Miocene (*Bellamya alberti*, Passage Beds, South of Lake Albert, Zaire, Gautier, 1970).

### 2. *Bellamya unicolor* (Olivier, 1804)

**(Plate 1)**

**Synonyms**

*Cyclostoma unicolor* Olivier, 1804,

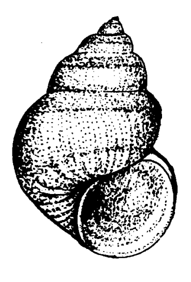
*Paludina unicolor* Kuster, 1852,

*Paludina aethiops* Reeve, 1863,

*Vivipara unicolor* Jickeli, 1874,

*Vivipara marlensi* Blanckenhorn, 1901,

*Vivipara (Bellamya) unicolor* Haas, 1936.



**H = 25 mm**

**Description**

The shell is dextral, thin in juveniles and sometimes fragile, but thick, hard, conical in full grown ones and has a long spire with a pointed apex. It is umbilicated with a hollow columella. It has delicate uniform oblique striations and the sculpture includes also fine transverse growth lines.

The whorls vary in shape from evenly convex to carinate. The last whorl is the largest, usually flattened at the periphery producing two blunt angulations. The convex whorls indicate riverine conditions, but in more permanent lacustrine environments, the shells have a tendency to become angular and / or develop ridges.

The aperture is almost circular in outline. The operculum is thin, corneous, flexible and concentric.

**Colour:** It varies in colour from pale yellowish to dark brownish. At the growing period, the growth part which starts from the outer lip is firstly coloured pale yellowish and after a period takes the colour of the rest of the shell.

**Size:** It varies in size, but the most dominant one is 22 (H) x 16 mm (D) and can reach to the height of 35 mm.

**Habitat**

It is common in all kinds of water bodies, including running, slowly flowing and stagnant water. *Bellamya* usually occurs in colonies with considerable numbers. In running water, they have been found attached to rubber wheels, plastic packets, debris and rocks. Sometimes they are found associated with *Ceratophyllum demersum* and are generally associated with the snail *Lanistes* in loams on rocks.

**Distribution**

**Local:** Along the River Nile and its main canals and Lake Nasser.

**World:** Lakes, slowly flowing rivers and streams of tropical Africa, south of Khartoum in the White Nile, in the Blue Nile as far as Lake Tana. Its northern limit in central and west Africa runs along Lake Chad, the River Niger, and the River Senegal (Brown, 1980).

**Status:** Common.

**Remarks**

It is viviparous and harbours various, larval trematodes of veterinary importance such as *Cercaria pusilla,* as well as the rat-lung nematode (*Angiosrongylus cantonensis*). Edible by bottom feeding fishes.

## FAMILY: AMPULLARIIDAE (PILIDAE)

Large to very large operculate snails. Mantle cavity is divided into a chamber with a gill and another as a lung, enabling the animals to respire air and to live in waters with very low oxygen content such as papyrus-swamps (Beadle, 1974). Females are oviparous. Afrotropical genera are able to withstand long periods of drought during which they aestivate in dry mud (Van Damme, 1988).

**Key to the genera**

1- Shell is sinistral and the operculum is corneous.................................*Lanists*

2- Shell is dextral and operculum is calcareous ........................................ *Pila*

### Genus: *Lanistes* Montfort, 1810

Medium-sized to very large sinistral snails, whorls are evenly curved, angular or carinata, operculum is entirely corneus and hence rapidly degraded. Three species of this genus, belonging to two different subgenera, occur in North Africa. The females are oviparous and the gelatinous egg clusters are deposited on submerged vegetation. Two species are known in Egypt.

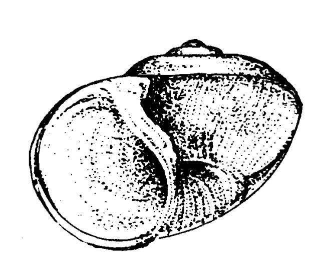
**Key to the species**

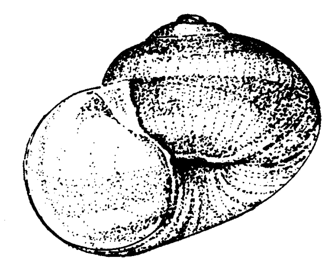
1- Shell depressed or with slightly tapered apex, distinctly wider than high and often carinate ................................................ *Lanistes carinatus*

2- Shell conical, distinctly higher than wide and never carinate ............................................................................................*Lanistes varicus*

### 3. *Lanistes carinatus* (Olivier, 1804)

**(Plate 1)**





**H = 30 mm**

**Synonyms**

*Helix bolteniana* Chemnitz, 1786,
*Ampullaria carinata* Olivier, 1804,
*Ampullaria bolteniana* Philippi, 1851,
*Ampullaria* (*Lanistes*) *bolteni* Mayer-Eymar, 1901,
*Lanistes bolteni* Pallary, 1909,
*Lanistes boltenianus* Pallary, 1924.

**Description**

The shell is sinistral, thin, sometimes fragile when juvenile, but thick, hard, relatively large globose and depressed in fully grown snails. In some individuals the spire is rather elevated.

The shell is broader than high, with a very wide umbilicus and usually angulated along the periphery and around the umbilicus. The spire is moderately elevated or depressed with a blunt apex.

The carina is quite sharp in young snails and distinct in the first two whorls in large shells. The sculpture includes fine striae, which are running in the direction of the growth lines and are continuous inside the umbilicus. The aperture is almost oval in outline, broader in the upper side than the umbilical side. The inner lip is closely applied to the columella and the outer lip is nearly convex. The operculum is a thin, flexible, oval corneus brownish disc.

**Colour:** The colour of the shell varies from pale yellowish in young to dark brownish in adult, with buffy bands.

**Size:** The average size is 25 (H) x 35 mm (D) but there are many variations in the height width ratio. The number of whorls increases more rapidly in younger snails than older ones and they can reach to about 5.2 whorls.

**Habitat**

*Lanistes* occurs firmly attached to rocks, plastic packets and rubber wheels. It is usually present in colonies and thrive in ditches and pools flooded by rain and the main Nile stream. The snails usually coexist with *Bellamya* and *Cleopatra.* They are associated with some aquatic plants like *Najas marina* subsp. *armata* and *Potamogeton nodosus.*

**Distribution**

**Local:** Along the River Nile and its tributaries from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

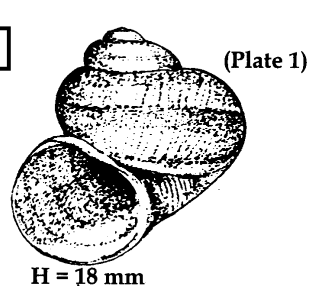
**World:** Slow-streaming rivers and their extensions (flood-plains and swamps) of the Nile drainge between Lake Kyoga and Egypt. Coastal areas of Sudan, Ethiopia, Uganda, Kenya and Somalia (DBL, 1973).

**Status:** Common.

**Remarks**

In Egypt, this *Lanistes* species was dealt with under the names *Lanistes carinatus* and *L.bolteni*, and some malacologists considered them as two different species, while others considered the latter as a variant and named it *L.carinatus* var. *perfecta* Pallary (Gardner, 1932). Both forms are identical except that the shell whorls in the former are carinate, while in the latter are rounded. In a recent electrophoretic study, Abdelmordy *et al.* (1997) proved that the two forms belong to only one species and there are no interspecific variations between them. It was reported to harbour the infective larvae of the rat-lung nematode, *Angiosrongylus cantonensis.* (Yousif and Ibrahim, 1978).

## 4. *Lanistes varicus* (Müller, 1774)



(Plate 1)

H = 18 mm

**Synonyms**

*Helix varicus* Müller, 1774,
*Lanistes guinaicus* Lamarck,
*Lanistes adansoni* Kobelt.

**Description**

The shell is sinistral, thin, relatively large, sub-globose with evenly curved whorls, a wide umbilicus and a large aperture. The operculum is a thin, flexible, oval, corneous brownish disc.

Shell is higher than wide, smooth without carina, angulated along the periphery and around the umbilicus. The spire is moderately elevated with a blunt apex.

The sculpture includes fine striae, which are running in the direction of the growth lines and are continuous inside the umbilicus. The aperture is almost circular in outline, the inner lip is closely applied to the columella and the outer lip is convex.

**Colour:** The colour of the outer shell (periostracum) has alternating brownish and yellow wide bands.

**Size:** The average size is 18 (H) x 15 (D) mm. The number of whorls (from 3-4) increases more rapidly in younger snails than older ones.

**Habitat**

It is firmly attached to rocks occurring in fast running water.

**Distribution**

**Local:** Nile water of Upper Egypt.

**World:** Ghana, Gambia, Senegal, Mali, Upper Volta and Niger (Brown, 1980).

**Status:** Rare

## Genus: *Pila* Rding, 1798

Medium-sized to very large (over 100 mm high) dextral snails, with convex non-angular whorls. Operculum with a thick calcareous layer. Bell (1966) revised the taxonomy of the species of *Pila* described from Sudan and concluded that they all belong to one, polymorphic species *Pila ovata*. This opinion is now rejected (DBL, 1973, Brown, 1980) and two species are recognized in North Africa: *P. ovata* and *P. wernei*. The oldest known occurrence of this genus in Africa dates back to the Lower Eocene (*Pila colchesteri*, Sudan; Cox, 1933).

**Key to the species**

1- Shell is rather small, less than 70 mm high, and usually with a rather high spire. Operculum is relatively broad ................................ ***Pila ovata***

2- Shell is very large, up to 130 mm high and usually with a low spire .............................................................................................................. ***Pila wernei***

### 5. *Pila ovata* (Olivier, 1804)

**(Plate 1)**

**Synonyms**

*Ampullaria ovata* Olivier, 1804,

*Ampullaria kardofana* Philippi, 1914,

*Pila ovata dartevellei* Pain, 1961.

**Description**

**H = 45 mm**

The shell is dextral with relatively a high spire, and very thick, striated, rapidly increasing 4 - 5 whorls.

Body whorl is highly convex, rounded, inflated and its volume comprising most of the shell. Aperture is ovoid and has an outer thick circular lip and an inner columellar lip. Umbilicus is closed.

**Colour:** Surface is shining, relatively smooth, dark brownish in colour, and sculptured with horizontal faint yellowish striations and prominent regular lines of growth.

**Size:** The average size is 57 (H) x 45 mm (D).

### Habitat

Marshy low banks of rivers or swamps, ponds, lakes, and isolated localities such as oases. It prefers clear, slowly- flowing water with vegetation such as *Eichhornia crassipes.*

### Distribution

**Local:** Bahr Youssif in Fayoum, Siwa Oasis and various other parts of the Nile, as well as Lake Nasser.

**World:** Uganda, Kenya, Tanzania, Eastern Zaire and the Victoria Nile (DBL, 1973) and S.Nigeria (Brown, 1980).

**Status:** Rare.

## 6.*Pila wernei* (Philippi, 1851)

**Plate 1)**

### Synonyms

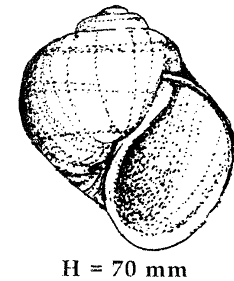
*Ampullaria wernei* Philippi, 1851,

*Pila wernei* Pilsbry and Bequaert, 1927.

### Description

The shell is dextral, striated, thick, and formed of 5 whorls. It is the largest African freshwater gastropod. It is distinguished from *Pila ovata* by its shorter, more obtuse spire, with correspondingly flattened whorls. The spire is shorter than the aperture.

Body whorl is highly convex to globoid, highly inflated with a distinct shoulder, and its volume comprising most of the shell. Aperture is ovoid with an outer circular lip and inner columellar reflected lip. The outer lip is angulated above and umbilicus is wide.



**H = 70 mm**

**Colour:** Surface is relatively smooth with shining orange colour, and sculptured with faint horizontal striations in addition to prominent lines of growth.

**Size:** The average size is of H = 70 mm, D = 60 mm.

### Habitat

Similar to that of *Pila ovata.*

### Distribution

**Local:** Nile water of Upper Egypt.

**World:** Sudan and Mali (Pain, 1961), Wadi Howar (Arkell, 1953), Lake Chad (Lvque, 1967), Somalia, and Namibia.

**Status:** Rare.

## FAMILY: VALVATIDAE

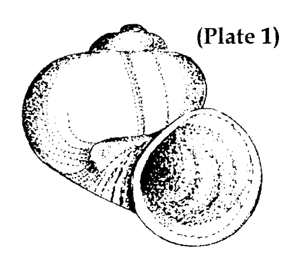
Shell is small to medium sized, dextral, umbilicate, with rounded whorls which are either smooth or carinated. Operculum is horny, concentric and multispiral.

### Genus: *Valvata* Müller, 1774

Genus *Valvata* occurs in North America, Europe, Asia and N.E. Africa. The snails are hermaphrodite, deposit gelatinous egg clusters which may adhere to birds or to aquatic insects (Zhadin, 1952). Only one recent species occurs in Africa. The oldest known occurrence in Africa dates to the Middle Pliocene (Williamson, 1981).

### 7. *Valvata nilotica* Jickeli, 1874

(Plate 1)



**Synonyms**

*Valvata (Cincinna) innesi* Pallary, 1902,
*Valvata (Cincinna) nilotica* Pallary, 1909.

**Description**

**H = 4.0 mm**

The snail is dextral, small with low spire and obtuse or blunt apex. The shell is thin, globose, with very rapidly increasing down-winding whorls and with a very wide umbilicus. The surface is smooth, glossy and the sculpture consists of fine growth lines.

The whorls are shouldered or with a lateral angle which runs along the early whorls and becomes less distinct and rounded in the body whorl. There are $3^{1}/_{3}$ whorls, separated by deep sutures. The aperture is generally circular and the operculum is a thin, flexible and rounded horny yellowish disc.

**Colour:** The colour of shell varies from creamy to yellowish.

**Size:** The shell with a maximal size of 4 .5 mm (H) x 6 .5 mm (D).

**Habitat**

Slowly flowing rivers and streams with dense aquatic vegetation. It occurs on aquatic plants and in pools in Lower Egypt. The snail is highly associated with *Potamogeton trichoides* and *Najas minor.*

**Distribution**

**Local:** Lower Nile and its main canals as well as Lake Nasser.

**World:** Ethiopian Highlands (Brown, 1980).

**Status:** Rare.

**Remarks**:

*Valvata nilotica* is closely related to the S.W. Asian *V.sauleyi.* It is presently restricted to N. E. Africa, but during the late Pleistocene-Holocene it spread as far West as South Algeria. (Van Damme, 1988).

## FAMILY: BITHYNIIDAE

Representatives of this family are oviparous. In Africa there are 8 genera, 7 of which are endemic. Only one is found in Egypt, known as *Gabbiella.*

### Genus: *Gabbiella* Mandahl-Barth, 1968

Small snails, up to 9 mm high. Operculum with a calcareous layer extending to its margin and a spiral nucleus occupying up to 4/5 of the diameter. The genus is found throughout Africa, except in the north-west. Identification of empty shells is difficult since distinctive characters include shape of operculum, central radular tooth and penis.

### 8. *Gabbiella senaariensis* (Küster, 1852)

**(plate 2)**

**Synonyms**

*Paludina senaariensis* Küster, 1852,

*Bithynia goryi* Bourguignat, 1856,

*Bithynia senaariensis* Martens, 1865,

*Bythynia* (*Gabbia*) *sennaarica* Pallary, 1909,

*Bithynia tilhoi* Germain, 1912.

**H = 8.8**

**Description**

The snail has a spire that is usually distinctly higher than the aperture. The shell is dextral, conical with a blunt apex. It is thin with closed umbilicus and solid columella.

The whorls are convex and separated with moderately deep sutures, the last whorl is large and globose. The aperture is ovoid in outline. The inner lip is distinct and clearly protruding from the body whorl, but the outer one is slightly convex. The operculum is a thin oval,

yellowish horny disc, and the spiral part occupies 1/3 or less of the diameter. The nucleus lies nearer to the columellar side.

**Colour:** The shell is transparent with a glossy appearance.

**Size:** The typical form is about 8.5 (H) x 5.5 mm (D), but some subspecies are very small. The colour varies from light yellowish to brownish.

**Habitat**

It prefers localities with running water, common in the Nile. It is usually associated with some aquatic plants such as *Ceratophyllum demersum* in fine sand or clay.

**Distribution**

**Local:** Along the River Nile and its tributaries, from Lake Nasser to Rosetta and Damietta branches (Lower Egypt).

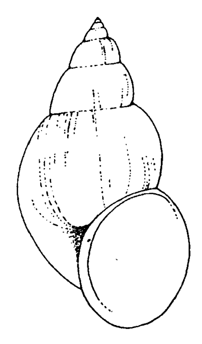
**World:** Large rivers and lakes, and their extensions in tropical Africa. Found in the Nile from the Victoria and Albert Lakes to Lower Egypt. In West Africa along Lake Léné (Central African Republic) to Lower Egypt (Dejoux *et al.*, 1971), the Yob River in Nigeria and Bengou in Niger (Brown, 1980).

**Status:** Common

**Remarks**

*Bithynia connollyi* Gardner, an acuminate ovate (8.8x4.7mm) species with 5 convex regularly striated whorls, has been recorded by Gardner (1932) in Fayoum. The operculum is unknown and its taxonomic position remains uncertain. It may be a different morph of *Gabbiella senaariensis* or may be a hydrobiid (Van Damme, 1988).

Some subspecies of *G. senaariensis* are smaller in size, such as *Bithynia goryi* Bourguignat, *Bithynia tilhoi* Germain and *Bithynia neumanni* Martens, which were recorded by Gardner (1932) in Fayoum area. He considered them as distinct species, but Brown (1980) considered them as isolated subspecies populations. Mandahl-Barth (1988) considered *Bithynia tilhoi* Germain as a distinct species, based upon the study of specimens from Kiba, Besun (Van Damme, 1988).



**H=8.8 mm**
***Bithynia connollyi***
**(after Gardner, 1932)**

## FAMILY: THIARIDAE (MELANIIDAE)

Four genera, each with one species, are found in the Eastern Mediterranean region and none is of medical or veterinary importance. Only two of them are found in Egypt.

**Key to the genera**

1- Shell is turriform usually with both transverse and spiral sculpture. The operculum is spiral ............................................................ ***Melanoides***

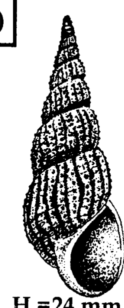
2- Shell is conical and ovate. Collumellar margin is not truncated. The operculum is concentric................................................................***Cleopatra***

### Genus: *Melanoides* Olivier, 1804

Medium-sized to large snails (reaching 50 mm high) with a high and slender spire. Both transverse and spiral sculptures are commonly present. Only one species occurs in Africa, the now cosmopolitan *Melanoides tuberculata*. It is parthenogenetic and can be dispersed by birds and man.

### 9. *Melanoides tuberculata* (Müller, 1774)

**(Plate 2)**



H =24 mm

**Synonyms**

*Nerita tuberculata* Müller, 1774,

*Melanoides fasciolata* Olivier, 1804,

*Melanoides tuberculata* Olivier, 1804,

*Melania tuberculata* Jickeli, 1874,

*Melania* (*Melanoides*) *tuberculata* Pallary, 1909.

**Description**

The snail has a sculpture of spiral ridges and ribs. The shell is dextral, elongated with a long spire, much higher than the aperture and with a pointed apex. It is thick and hard, having a solid columella and a closed umbilicus. In most snails, the spiral rows have brown elongated patches of different sizes. The sculpture includes also fine transverse lines of growth.

The aperture is oval in outline, broader below than above, forming about 1/3 of the total length of the shell. The outer lip appears slightly convex while the inner lip is closely applied to the columella.

The operculum is a thin flexible, oval, corneous, brownish disc which is broader in the left side (columellar) than in the right. Also the nucleus lies nearer to the columellar side of the operculum with growth lines extending out of this eccentric nucleus in a spiral manner.

**Colour:** The colour of the shell varies from greyish, brownish to yellowish with brown sculpture.

**Size:** The maximal size is 47 (H) x 14 (D) mm and the common size is 24 x 9 mm.

**Habitat**

It lives in stagnant and slowly running water, and tolerates high salinity to certain extent. The snail is highly associated with the aquatic plants *Myriophyllum spicatum, Ceratophyllum demersum, Potamogeton crispus, Potamogeton pectinatus* and *Eichhornia crassipes.*

**Distribution**

**Local:** Along the River Nile and its tributaries, from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

**World:** Chad, Senegal River, in the Upper and Lower Niger and in East and S. E. Africa. All countries in the Mediterranean region, Southern Asia and Australia and the Hebrides; introduced into the Southeastern United States and into Cuba.

**Status:** Common.

**Remarks**

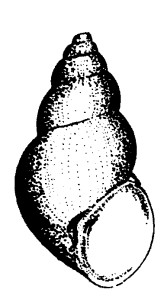
It harbours several species of cercariae. It acts as first intermediate host for *Lecithodendrium pyramidum* which has the adult stage in bats. It is edible by bottom feeding fishes

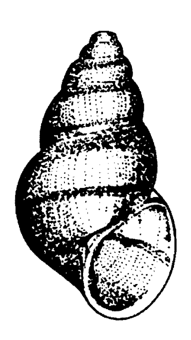
## Genus: *Cleopatra* Troschel, 1856

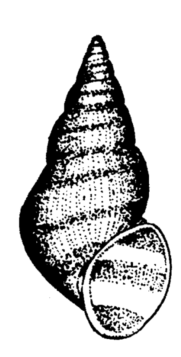
Medium-sized snails (reaching 30 mm high). Shell is ovate and usually with a conical spire and dark spiral bands. This afrotropical genus is found from Upper and Lower Egypt to Zululand and extends westwards till Senegal. It is also known from Syria and Yemen. The females are believed to be oviparous (Brown, 1980). In Egypt, only one species was recorded.

## 10. *Cleopatra bulimoides* (Olivier, 1804)

**(Plate 2)**







**H = 23 mm**

**Synonyms**

*Cyclostoma bulimoides* Olivier, 1804,

*Paludina bulimoides* Chenu, 1839,

*Cleopatra bulimoides* Jickeli, 1874,

*Cleopatra pirothi* Jickeli, 1881,

*Cleopatra emini* Smith, 1888,

*Vivipara (Cleopatra) bulimoides* Longstaff, 1914,

*Cleopatra bulimoides* var. *richardi* Germain, 1916.

**Description**

The shell is dextral, thick, hard, smooth with evenly curved whorls. It is conical to globose with more or less pointed apex. It has a narrow umbilicus and hollow columella. The sculpture of the shell consists of parallel transverse fine lines.

The aperture is ovoid in shape consisting of nearly $^2/_5$ of the total length of the shell. The outer lip appears rather convex and the inner lip is closely related to the columella.

The operculum is concentric, thin, corneous, flexible and brownish oval disc with a small spiral nucleus and the growth lines are observed concentrically on the operculum. The nucleus lies nearer to the left or columellar side.

**Colour:** The colour varies from light brownish to dark brownish or light brownish adorned with one or two dark bands on each whorl.

**Size:** The average size is 16 (H) x 8.5 mm (D), but sometimes larger. The number of whorls varies from 5.1 to 6.5.

**Habitat**

Slowly flowing localities, running water on both sides of the River Nile and the bottom especially in the Upper Nile. It is generally found in sandy, and often in rocky habitats associated with the bivalves *Caelatura* and *Etheria*. In Lower Egypt, it is usually found in association with *Bellamya, Theodoxus, Bulinus* and *Lanistes*. Also, it is generally associated with many aquatic plants such as *Ceratophyllum demersum, Myriophyllum spicatum, Potamogeton crispus, Potamogeton pectinatus, and Eichhornia crassipes.*

**Distribution**

**Local:** Along the River Nile and its tributaries from Upper Egypt to Rosetta and Damietta branches (Lower Egypt) as well as Lake Nasser.

**World:** Sudan, Kenya, Ethiopia and Somalia and with a westward extension into Chad, Senegal and Gambia (Brown, 1980; Van Damme, 1988).

**Status:** Common.

**Remarks**

It acts as intermediate host for *Gastrodiscus aegypticus* and *Prohemistomum vivax*, as well as several other trematodes. It is edible by many bottom feeding fishes.

# FAMILY: HYDROBIIDAE

The shell is small or very small, varying from depressed globose to conical or turreted. Aperture is usually with an entire peristome. Operculum is corneous and spiral. The family comprises a great number of genera but their taxonomy is far from being well known, and a sound revision is needed. All species are yet without medical or veterinary importance.

## Genus *Hydrobia* Hartmann, 1821

The oldest occurrence of this genus in Africa probably dates from the Early Eocene in Sudan (Cox, 1933).

**Key to species**

1- Full grown shells between 6 and 7 mm, very slender ***Hydrobia aponensis***

2- Full grown shells rarely exceed 5 mm

- Whorls are rather flat and sutures are shallow ..... ***Hydrobia musaensis***
- Whorls are convex and separated by deep sutures... ***Hydrobia ventrosa***

## 11. *Hydrobia aponensis* Martens, 1874

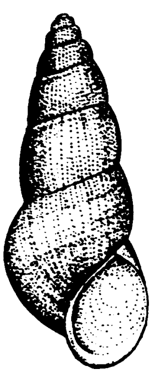
**Synonyms**

*Hydrobia peraudieri* Bourguignat, 1862,

*Paludestrina peraudieri* Smith, 1908.

**Description**

The shell is narrow, elongated slender to very slender. The height is from 6 to 7 mm and its diameter is about 1.5 mm. The sutures are deep and distinctly oblique and the average number of whorls is 7. The aperture is ovate.



**H = 7.0 mm**

**Habitat**

Irrigation channels, small streams, oases, artesian wells, warm springs, etc. It can be found in fresh to brackish water (up to 8.5 g Cl / l).

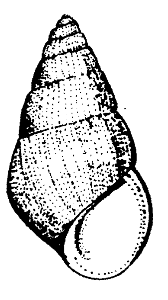
**Distribution**

**Local:** Extinct [It was recorded in Fayoum area (Lake Qarun) and Upper Egypt (Gardner, 1932; Gautier, 1980)].

**World:** Morocco, Tunesia, Algeria, Spain, France, Italy, Yugoslavia and Greece (Boeters, 1976).

**Status:** Extinct from Egypt.

## 12. *Hydrobia musaensis* (Frauenfeld, 1855)



**H = 5.0 mm**

**Synonyms**

*Paludina musaensis* Frauenfeld, 1855,

*Hydrobia stagnalis* Blanckenhorn, 1901.

**Description**

The snail has a small, relatively broad shell, (4.6 x 2 mm), consisting of 6 whorls.

Aperture is oval and acute at the top. Sutures are shallow and the whorls are more flattened than the foregoing species.

**Habitat**

Fresh and brackish waters.

**Distribution**

**Local:** Siwa Oasis, northern lakes, Fayoum area and Ain Musa well in Sinai.

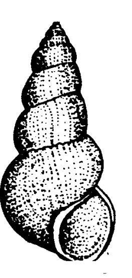
**World:** Libya, S.W. Asia and the Arabian Peninsula (Brown and Wright, 1980).

**Status:** Common.

**Remarks**

Mandahl-Barth (1988) argued that the Egyptian *Hydrobia musaensis* should be classified under *H.ammonis.* Therefore, further anatomical and morphological studies are needed.

## 13. *Hydrobia ventrosa* (Montagu, 1803)



**H= 4.8 mm**

### Synonyms

*Turbo ventrosa* Montagu, 1803,

*Hydrobia stagnalis ventrosa* Blanckenhorn,1901,

*Paludestrina peraudieri* Smith, 1908.

### Description

The shell is small, narrow, consisting of 6 very convex whorls; aperture is oval and umbilicus is open.

**Size:** 4.5 (H) x 2.2 mm (D).

### Habitat

Brackish coastal waters.

### Distribution

**Local:** Lake Qarun, Siwa Oasis and brackish coastal waters of northern lakes.

**World:** Tunesia and British Islets.

**Status:** Common.

# B- SUBCLASS: PULMONATA

## ORDER: BASOMMATOPHORA

All freshwater pulmonates are non operculate and belong to the order Basommatophora characterized by the position of the eyes at the bases of the tentacles. They are hermaphroditic, oviparous with separate male and female genital openings.

The shell of African Basommatophora is rather small and seldom exceeding 25 mm. It is dextral or sinistral. Regarding the shape, there are 3 different types: cap-shaped, ovate and disc-shaped shell.

The Basommatophora are typically lung-breathing aquatic snails, but in some species, an accessory gill or pseudobranch has been developed. Many of them are of great medical or veterinary importance as intermediate hosts of trematodes, causing serious diseases for man and his livestock. In Egypt, representatives of this order belong to five families, including eleven genera.

## FAMILY: LYMNAEIDAE

The shell is small to large, thin or of moderate thickness, orthotropic and conispiral (elongate in most species) or patelliform (Lanx). Conispiral species are holostomatous, with an aperture typically angled above and rounded below, umbilicate or non-umbilicate, and sculptured with collateral lines and with or without periostracal ridges and additional microsculpture. Monoecious (with facultative cross and self-fertilization) and phytophagous.

### Genus: *Lymnaea* Lamarck, 1799

Dextral snails with a pointed spire, reaching over 25 mm high in the largest tropical African species. This is a particularly interesting genus for the biologists and geologists, since of all the freshwater molluscs, it seems to respond most readily to varying conditions. If, therefore, the origin of the different types of variation can be determined, a very valuable geological clue may be obtained. Seven species occur in Africa, but only *Lymnaea natalensis* is ubiquitous. The American *L. columella* (Say, 1817) is a recent addition to the African fauna. It first appeared in South Africa in 1944 and has now been introduced into several areas, such as in Lower Egypt.

**Key to the species**

1- Length of spire is usually about 1/5 to 1/4 the length of the shell aperture. The shell is slender with a relatively higher spire and without spiral lines ........................................................ ***Lymnaea natalensis***

2-The shell is narrower than *L.natalensis* and is easily distinguished with very distinct growth lines. Spire much shorter than aperture ................................................................................................ ***Lymnaea columella***

3- The whorls rapidly increasing. Body whorl much larger than other whorls. Spire as high or slightly smaller than aperture ................................................................................................ ***Lymnaea stagnalis***

4- The whorls are not bulging. The shell is elongate ovate with a short spire .................................................................................... ***Lymnaea peregra***

5- Length of spire is about one-tenth of aperture. Upper margin of aperture is turning upward and forming a lip. Outer margin is strongly convex ......................................................... ***Lymnaea auricularia***

6- Full grown shell is less than 15 mm high. Whols are strongly convex, periphery flattened, spire scalariform ...................... ***Lymnaea truncatula***

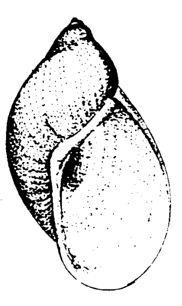
7- Full grown shell is 20 to 22 mm high. Whorls are slightly convex, periphery curved ........................................................... ***Lymnaea palustris***

## 14. *Lymnaea natalensis* Krauss, 1848 (= *Lymnaea cailliaudi* Bgt.)

**(Plate 2)**

**Synonyms**

*Lymnaeus (Radix) natalensis* Krauss, 1848,
*Lymnaeus natalensis* Jickeli, 1874,
*Lymnaea cailliaudi* Bourguignat, 1883,
*Lymnaea arabica* Smith, 1894,
*Lymnaea alexandrina* Pallary, 1909,
*Limnaea (Radix) exserta* Martens, 1914,
*Lymnaea (Radix) africana* Germain, 1920,
*Limnaea (Radix) natalensis* Undussumae, 1927,
*Lymnaea peregra* Leigh and Butzer, 1968.



**H = 23 mm**

### Description

The shell is dextral, thin somewhat fragile and transparent. It is elongated, ovoid in outline with a spire shorter than the aperture. It is possible to differentiate this species on the basis of the slender shell and relatively higher spire with an acute apex.

The whorls are spirally coiled and increase rapidly in height. The number of whorls may reach 4 whorls, tightly coiled, convex and separated by deep sutures. The body whorl is not bulging and forms the greatest portion of the shell.

The sculpture includes fine transverse lines of growth. The sculpture is distinct on the body whorl but less distinct on the preceeding whorls. The aperture is ovate and broader below. The columella is a gradual spiral, hardly folded, and with a slight outward bend. The umbilicus is completely closed by the expanded and reflected inner lip.

**Colour:** The colour of the shell varies from glossy, pale yellowish, brownish to dark brownish.

**Size:** The average shell size is about 23 (H) x 15 mm (D). There is a rapid increase in number of whorls in the small-sized snails, but becomes slower in older individuals.

### Habitat

It is found in fairly shallow water near the shore, comparatively permanent waters, including lakes, rivers, khors, flooded areas and irrigation canals. It is rare in seasonal pools, although aestivation up to 6 months has been reported (Bitakaramire, 1968). The snail is highly associated with some aquatic plants such as *Ceratophyllum demersum, Potamogeton crispus, Eichhornia crassipes, Paspalam distichum* and *Lemna gibba.*

### Distribution

**Local:** Along the River Nile and its tributaries from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

**World:** Throughout Africa except in the coastal region of East Africa and Namibia. Its northern limit is the Ghambia River (Daget, 1961), Niamey, Mopti (Brown, 1980), Lake Chad (Lévêque, 1967), Zalinguei in Sudan (Brown, 1980). In Yemen, Oman, Jordan, Palestine, also found on Madagascar and neighbouring Islands.

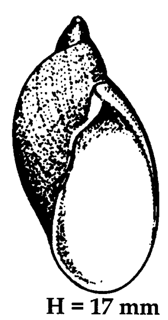
**Status:** Common.

**Remarks**

*Lymnaea natalensis* is the intermediate host for *Fasciola gigantica,* which is a common liver fluke found in ruminants and occasionally in humans, all over Africa. *Fasciola gigantica* is of great economic, veterinary as well as medical importance. *L. natalensis* together with, *Bulinus truncatus* and *Biomphalaria alexandrina* are considered the main sources for transmitting many diseases to man and his livestock in Africa. It is also the intermediate host for other non human larval trematode parasites, some of which may cause cercarial dermatitis ("Swimmers" itch).

## 15. *Lymnaea columella* (Say, 1817)

**(Plate 2)**


**H = 17 mm**

**Synonyms**

*Lymnaeus macrostomus* Say, 1821,
*Limnaea chalybea* Gould, 1840,
*Lymnaea casta Lea*, 1841,
*Lymnaea peregina* Meeuse and Hubert, 1949.

**Description**

The shell is up to $^3/_4$ inch in length, thin and fragile to slightly thickened, with a capacious body whorl and a large, ovate aperture. Protoconch with about $1^1/_4$ whorls forming a small and dark brown apex. The spire is sharply conical, rather short and narrow with well-impressed and constricted sutures.

Whorls are about four, rounded, but not inflated and rapidly enlarging. The body whorl is comprising about $3/_4$ the length of the shell. Aperture is ovate, expanded basally and widely opened. Outer lip is thin and sharp. Inner lip is closely appressed to the parietal wall and covering the umbilicus or leaving open only a narrow slit.

The parietal wall is arched, therefore in some specimens the inside of the shell is visible almost to the apex when viewed from the base. Columella plait is clearly visible and gyrate, but not heavy or well developed. The sculpture consists of moderately coarse and crowded collateral lines, darker and lighter collateral streaks, and numerous crowded spiral lines.

**Colour:** The colour of the outer shell varies from light greenish-brown to yellowish-brown variable.

**Size:** The average size is about 17 (H) x 9 mm (D).

**Habitat**

Along the shore in shallow stagnant water, a locality with an abundance of lily pads, with the same kinds of plants of *Lymnaea natalensis*, and on rocky shores which are protected from wave action.

**Distribution**

**Local:** Lower Egypt (the Nile and its main canals) Damietta and Rosetta branches of the Nile especially in El-Qaluobyia, El-Minoufyia and Damietta regions.

**World:** Eastern North America, Western Cuba, Central Mexico, Honduras and Nicaragua (Hubendick, 1951). Southern Brazil and Southern Argentina, Europe, South Africa, and Western United States.

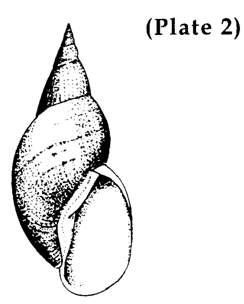
**Status:** Rare.

**Remarks**

*Lymnaea columella* is an American species introduced into Africa in 1944 (Mandahl- Barth, 1968). It is a possible intermediate host for *Fasciola hepatica*.

## 16.*Lymnaea stagnalis* (Linnaeus, 1758)

**(Plate 2)**



H = 20 mm

**Synonyms**

*Helix stagnalis* Linnaeus, 1758,

*Lymnaeus appressus* Say, 1818,

*Lymnaea stagnalis appressa* Say, 1818,

*Lymnaea moeris* Martens, 1886.

**Description**

The shell is dextral, large, elongate ovate, thin to rather thick, striated, rimate, and high spired. Spire is narrow, elongate, and composed of about 4-5 high, flat-sided whorls or not very convex, forming a mamillate apex.

Body whorl is convex, rounded, inflated, fairly ventricose, and in volume comprising most of the shell. Aperture is ovate, a little longer than the spire, moderately angulate above, columellar fold and callus are distinct. Outer lip is thin and

fragile. Parietal wall is covered with a thin but prominent callus. Umbilicus is absent or indicated by a small chink.

**Colour:** Outer surface is shining, relatively smooth, tan to brown, and sculptured with prominent collateral lines, prominent lines of growth, and fine spiral lines.

**Size:** The average size is H = 19 mm, D =10 mm.

**Habitat**

Slowly running and standing water. Also in temporary pools. It is associated with a remarkable deposit consisting almost entirely of rounded calcareous grains the size of a pea.

**Distribution**

**Local:** Wadi el Natroun (Brown, 1980). Previously, it was recorded from Fayoum area (Gardner, 1932), and Kom Ombo region (Leigh and Butzer, 1968), and was known as *Limnaea moeris.*

**World:** Europe and Asia, Northern Africa from the Atlas Mountains (Dumont, 1979), Tanger (Pallary, 1901).

**Status:** Rare.

## 17. *Lymnaea peregra* (Müller, 1774)

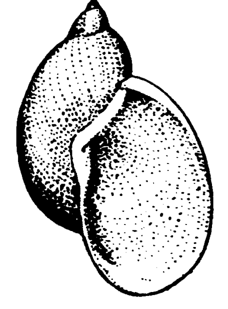
**(Plate 2)**

**Synonyms**

*Radix peregra* Müller, 1774,

*Lymnaea limosa* Bourguignat, 1862,

*Lymnaea ovata* Bourguignat, 1864.



**H = 20 mm**

**Description**

The shell is dextral, thin, somewhat fragile transparent, elongate - ovate with rather big spire and pointed apex. Outer margin is ovoid. The whorls are spirally coiled and increase rapidly in height. The number of whorls can reach to 4.1 whorls, which are tightly coiled, convex and separated by deep sutures.

The body whorl is bulging, and forms the greatest portion of the shell with an ovoid outer margin.

The sculpture includes fine lines of growth, being distinct on the body whorl, but less distinct on the early whorls. The aperture is highly ovoid, formed of an outer ovoid lip and inner reflected columellar margin which is tightly closed to the body whorl.

The umbilicus is completely closed by the expanded and reflected inner lip. Rapid increase in number of whorls appears in small-sized shells and becomes slower in older ones.

**Colour:** The colour of the shell varies from transparent light brownish to faint yellowish.

**Size:** The average size is 18 (H) x 9.5 mm (D).

**Habitat**

It occurs in all types of water bodies, including running and stagnant waters, as well as rivers and irrigation canals. The snail is highly associated with some aquatic plants such as *Ceratophyllum demersum, Potamogeton crispus, Eichhorina crassipes, Paspalam distichum* (= *P. paspaloides*) and *Lemna gibba.*

**Distribution**

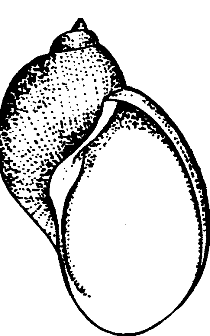
**Local:** Lower Egypt, Rosetta and Dameitta branches of the Nile. It is very rare and Van Damme (1988) claimed that it is not found in Egypt, but Leigh and Butzer (1968) collected some of their shells from Kom Ombo region.

**World:** Europe and Asia. In Africa restricted to Morocco (Dumont, 1979; Brown, 1980) and Algeria (= *Lymnaea ovata* Bourguignat, 1864).

**Status:** Rare

## 18. *Lymnaea auricularia* (Linnaeus, 1758 )

(Plate 2)



H = 17 mm

**Synonyms**

*Helix auriculatia* Linnaeus, 1758,
*Lymnaea lagotis* Schrank, 1803,
*Lymnaea acutus* Jefferys, 1833,
*Lymnaea vulgaris* Pfeiffer, 1835,
*Gulnaria auricularia* var. *logotis* Clessin, 1884,
*Lymnaea canalis* Pallary, 1901,
*Radix lagotis* Schrank, 1925.

**Description**

The shell is dextral with a large aperture. Large shells (17.5 x 14.5 mm) differ from *Lymnaea natalensis* by a very short spire. The upper part reaches about the shoulder of the body whorl. The spire is short and sharply pointed. In the typical shell the columellar fold is pronounced.

**Habitat**

Streams, pools and other types of water bodies

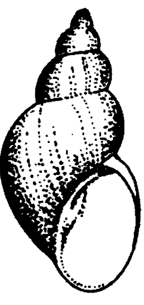
**Distribution**

**Local:** Very rare in Lower Egypt. Gardener (1932) recorded it in Fayoum area while Leigh and Butzer (1968) collected shells from Kom Ombo region.

**World:** Europe, Iran, Saudi Arabia and Lower Egypt (Van Damme, 1988)

**Status:** Rare

## 19- *Lymnaea* (*Galba*) *truncatula* (Müller, 1774)



H = 10 mm

**Synonyms**

*Buccinum truncatula* Müller, 1774,
*Lymnaea* (*Fossaria*) *truncatula* Pallary, 1909.

**Description**

The shell is dextral and small with a maximum size of 11(H) x 6 mm (D). The spire is

of the same height as the aperture, and consists of 5 to 6 whorls which are distinctively convex .

**Habitat**

Small streams, pools and temporary waters in cool and humid areas.

**Distribution**

**Local:** Delta Region, the Baharia, Dakhla and Kharga Oases (Malek, 1959)

**World:** Ethiopia (Brown, 1965), Kenya (Brown, 1980), Morocco (Brown, 1980), Algeria (Bourguigant, 1864), Iraq, Iran, Palestine, Jordan, Oman, Pakistan and Syria.

**Status:** Rare

**Remarks**

*Lymnaea truncatula* is an intermediate host for *Fasciola hepatica,* which is a very common liver fluke in European ruminants.

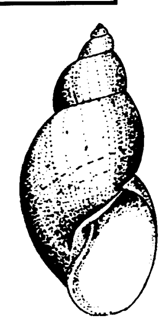
## 20. *Lymnaea (Stagnicola) palustris* (Müller, 1774)

**Synonyms**

*Buccinum palustris* Müller, 1774,

*Lymnaea palustris* Martens, 1886,

*Lymnaea moeris* Martens, 1886.



**H = 16 mm**

**Description**

The shell is dextral, resembling that of *Lymnaea truncatula* but larger (16 x 8 mm), and with less convex whorls that are often "hammered" or malleate (i.e. small areas of the surface flattened). The columella is more twisted. The growth lines are pronounced.

**Habitat**

Stagnant permanent and temporary freshwater bodies such as channels and swamps. Also in oligo-to mesohaline brackish water. It is a species of cold and temperate regions, and is able to survive long periods of desiccation.

**Distribution**

**Local:** Extinct. It used to be found in Fayoum region (Martens, 1886; Blanckenhorn, 1901), and in Kom Ombo region (Leigh and Butzer, 1968).

**World:** Saudi Arabia, Morocco (Hubendick, 1951), Algeria, Iran, Palestine, Jordan, Oman and Syria

**Status:** Extinct from Egypt.

## FAMILY: SUCCINEIDAE

### Genus: *Succinea* Draparnaud, 1801

It is restricted to the River Nile.

### 21. *Succinea (Amphibina) cleopatra* (Pallary, 1909)

**(Plate 2)**

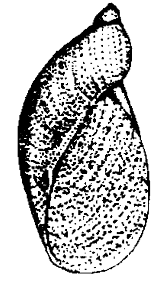
**Synonyms**

*Oxyloma cleopatra* Audouin, 1827,

*Succinea amphibina* Audouin, 1827,

*Succinea aegyptiaca* Ehrenberg, 1830,

*Succinea indica* Jickeli, 1874.



**H = 12 mm**

**Description**

The shell is thin, fragile, dextral and somewhat transparent. It is elongated ovoid in outline with a short spire and blunt apex. The shell is not umbilicated and the spire is shorter than the aperture. The number of whorls varies from 3 to 4.

The whorls are spirally coiled and increase rapidly in height with a very narrow last whorl which is characteristic for *Succinea.* The sculpture includes uniform close set of fine oblique growth lines and the apparent sutures which separate the whorls. The aperture is large ovate and constitutes about 75% of the shell length. The outer lip is convex and the inner lip is highly applied to the columella.

**Colour:** The colour of the shell varies from light yellowish to brownish or dark brownish.

**Size:** The shell varies in length until more than 23 mm and the average size is about 12 (H) x 6.2 mm (D).

**Habitat**

Amphibious snail living sometimes on reeds in water and sometimes on damp ground. They climb aquatic plants, such as *Spirodela polyrhiza* and *Sphaeranthus suaveolens*.

**Distribution**

**Local:** Along the River Nile and its tributaries from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

**World: Endemic** to Egypt.

**Status**: Common.

## FAMILY: PLANORBIDAE

This family, from the viewpoint of medical malacology and public health, is the most important of all the families of freshwater snails found in Africa and Mediterranean region. The family is divided into the following two subfamilies: Planorbinae and Bulininae.

### Subfamily: Planorbinae

It consists of species with a discoid or lentiform pseudo dextral shell. The animal is always sinistral, its anus, pneumostome and genital openings, being found on the left side. Six genera are known to occur in Egypt.

**Key to genera**

1- Large species, shell is more than 2 mm high (2-3 mm) and usually with a distinct angle below the periphery.......................................... ***Planorbis***

2- Shell is less than 6 mm high. Peripheral angle and penial gland are absent........................................................................................ ***Biomphalaria***

3- Shell is relatively higher and in most cases with fewer and more rapidly increasing whorls, costulate or without sculpture....... ***Gyraulus***

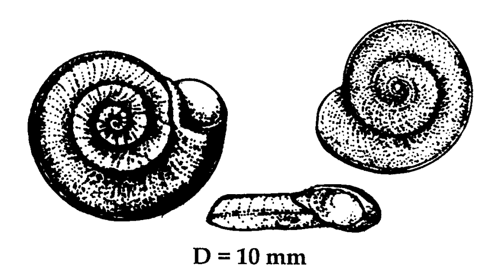
4- Shell is less than 5 mm in diameter; consisting of 4 to 5 slowly increasing whorls, which are rounded on the upper side and flat on the under side .................................................................................. ***Afrogyrus***

5- Shell is lentiform, with convex upper side and flat underside. The shell has 3 to 9 sets of internal septa............................................ ***Segmentorbis***

6- Shell is up to 14 mm high. Copulatory organ with a large accessory gland ........................................................................................ ***Helisoma***

## Genus: *Planorbis* Geoffroy, 1767

### 22. *Planorbis planorbis* (Linnaeus, 1758) (Plate 3)



**D = 10 mm**

**Synonyms**

*Helix planorbis* Linnaeus., 1758,

*Planorbis umbilicatus* Müller, 1774,

*Planorbis marginatus* Draparnaud, 1805,

*Planorbis intermedius* Charp, 1837,

*Planorbis subangulatus* Philippi, 1844,

*Planorbis* (*Tropidiscus*) *philippii* Pallary, 1909,

*Planorbis* (*Menetus*) *alexandrinus* Pallary, 1909.

**Description**

The shell is sinistral, thin, compressed, discoidal with spirally coiled whorls which increase slowly in diameter outwards. The shell is usually with a basal angulation along the periphery. The upper right side of the shell is convex while the lower left side is flattened.

The whorls at the apex are depressed, forming a depression which is almost as deep as the suture. Therefore, the suture on the right side

appears more deeply impressed than on the left one, showing a shallow umbilicus. The sculpture consists of fine closely curved growth lines.

The aperture is somewhat oblique, much broader than high and sharply carinate on the periphery under the equatorial line. It appears generally biconvex in outline. The upper lip extends outward than the lower one.

**Colour:** The colour varies from pale yellowish to dark brownish.

**Size:** The number of whorls varies from 4 to 5 and increases in number according to the size. The average size is about 2.5 (H) x 10 mm (D).

**Habitat**

Stagnant or slowly flowing, vegetation-rich, fresh or brackish waters. Usually associated with some aquatic plants, but its commonest associates are always the snails *Lymnaea* and *Gabbiella*.

**Distribution**

**Local:** Lower Egypt, except El-Dakahlyia. Also collected from Giza, and Siwa Oasis (Crawford, 1949).

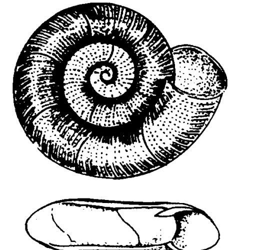
**World:** Europe and Southwest Asia (including Palestine and Jordan). In Africa, it occurs in Algeria and Morocco, mainly in the coastal region (Van Damme, 1988) also as far south as El Goléa and in southern Ethiopia (Brown, 1965 & 1980).

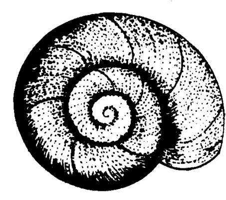
**Status:** Common.

**Genus: *Afrogyrus* Brown and Mandahl-Barth, 1973**

Small discoid snails rarely exceeding 5 mm diameter; penis with sub-terminal opening and a cap-like cuticular stylet.

**23. *Afrogyrus oasiensis* (Demian, 1962)**





**D = 2.5 mm**

**Synonym**

*Anisus oasiensis* Demian, 1962.

**Description**

The snail has a very small, brownish yellow, flat, discoidal shell consisting of 4 to 4.5 slowly increasing whorls, which are visible on both sides and not overlapping. The whorls are smoothly rounded, although a slight indication of an angle just below the middle can be noticed.

The aperture is small, slightly broader than high and not modified by any conspicuous carina. The peristome is simple and very thin. The sculpture consists of fine, close-set, curved growth lines.

**Size:** The shell of the average-sized snails measures 2.1 to 2.5 mm diameter and 0.7 mm in maximum height. The diameter of the umbilicus equals about half of the total shell diameter, and the width of the body whorl at the aperture is about 0.8 mm

**Habitat**

It lives mostly in streams near the water surface on damp floating objects and aquatic vegetation.

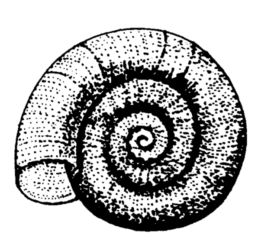
**Distribution**

**Local:** **Endemic** to Egypt. It is known only from the streams of a few springs in the Dakhla and Kharga Oases (Lybian Desert, Egypt). It has been collected in the streams of "Ain El-Maseed" in Dakhla Oasis and "Ain Debian" in Kharga Oasis (Demian, 1962; Van Damme, 1988).

**World:** *Afrogyrus oasiensis* has been described and collected for the first time in Egypt, and there are no records for this species in other countries (Van Damme, 1988).

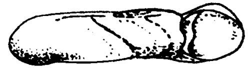
**Status:** Rare.

## 24- *Afrogyrus coretus* (Blainville, 1826)



**Synonyms**

*Planorbis coretus* Blainville, 1826,
*Anisus coretus* Blainville, 1826,
*Planorbis misellus* Morelet, 1848,
*Planorbis gibbonsi* Gardner, 1935,
*Anisus dalloni* Germain, 1935,



**D = 3.8 mm**

*Anisus fouladougouensis* Germain, 1935,

*Planorbis fouladougouensis* Fischer-Piette, 1948,

*Planorbis bellairei* Jodot, 1953.

**Description**

The snail is very similar in form to *Afrogyrus oasiensis*. They differ only in size. While the 4.5 whorled shell of the average adult specimens of *A. oasiensis* measures about 2.5 mm in its maximum diameter, that of *A. coretus* with the same number of whorls measures about 5 mm. Demian (1962) revealed also some close anatomical relationships between both species.

**Habitat**

Among permanent vegetation in calm water bodies throughout tropical Africa.

**Distribution**

**Local:** Lower Nile and Kharga Oasis, recorded as *Planorbis gibbonsi* and *Ceratophallus natalensis* (Gautier, 1980). From the external appearance it is very difficult to distinguish *Afrogyrus coretus* from young *Ceratophallus natalensis* (Brown *et al.*, 1984).

**World:** Northern limit of range in Senegal - Niger system and in the Lower Nile. Relict populations at Brak in the Fezzan (Libya) (Van Damme, 1988). Generally, it is rare in East Africa where it is known only from a few localities in the South Sudan, Uganda, Tanganyika and Zambia (Mandahl-Barth, 1968).

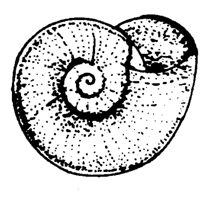
**Status:** Rare.

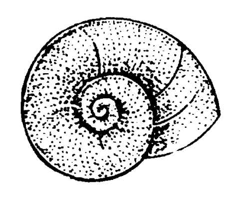
## Genus: *Gyraulus* Charpentier, 1837

It is closely related to genera *Afrogyrus* and *Anisus*, from which it differs mainly by the fewer and more rapidly increasing whorls.It has a world-wide distribution. In Africa there are about ten species, but only one occurs in Egypt.

### 25. *Gyraulus ehrenbergi* (Beck, 1837)

**(Plate 3)**







**D = 6.8 mm**

**Synonyms**

*Planorbis cornu* Ehrenberg, 1831,

*Planorbis ehrenbergi* Beck, 1837,

*Gyraulus costulatus* Krauss, 1848,

*Planorbis mareoticus* Letounreux, 1884,

*Gyraulus mareoticus* Innes, 1884,

*Planorbis laurenti* Bourguignat, 1884,

*Planorbis* (*Gyraulus*) *ehrenbergi* Pallary, 1909.

**Description**

The shell is flattened and discoidal in outline. It is usually fragile to thin in thickness. It is formed of spirally coiled whorls, increasing rapidly in size towards the aperture.

It has typically rounded whorls and a large mouth for the size of the last whorl or angulated with a distinct central keel. The shell is umbilicated on both sides in which all the whorls are visible and the last whorl is the biggest portion of the shell.

The sculpture comprises transverse irregularly spaced ridges and the lines of growth may be crossed with faint spiral ones. The sutures are generally more deeply impressed on both sides of the shell.

The aperture is ovoid or subovoid, broader than high and broader on the right side than the left one. The upper right lip is extending more outward than the lower one. The lateral lip from side view appears slightly convex and keeled. The inner lip is closely applied to the columella.

**Colour:** The colour varies from glossy whitish, yellowish to brownish.

**Size:** The number of whorls varies from 3 to 4 and the average size of the shell is 1.7 (H) × 6.8 mm (D).

**Habitat**

Amongst dense vegetation in the Delta region of Egypt and in slowly running and permanent water bodies. The snail is highly associated with *Eichhornia crasspies, Ceratophyllum demersum* and *Potamogeton crispus.*

**Distribution**

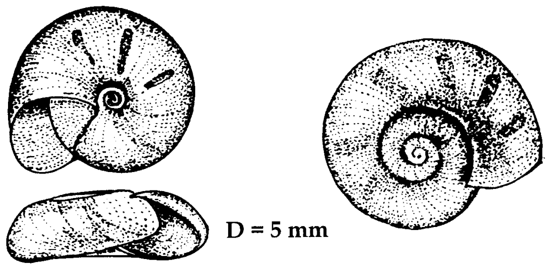
**Local: Endemic** for the Lower Nile except El-Gharbyia region. Also known from Giza and Fayoum areas as well as Lake Nasser. This species was recorded only from Egypt (Pallary, 1909, DBL, 1983, Van Damme, 1988).

**Status:** Common.

## Genus: *Segmentorbis* Mandahl-Barth, 1954

The shell is glossy, lens - shaped, consisting of 4 to 5 deeply embracing whorls of which the last one is provided with 3 to 9 sets of internal lamellae. It is a widespread afrotropical genus, represented by 5 species in Africa, of which one occurs in Egypt.

### 26. *Segmentorbis angustus* (Jickeli, 1874) (Plate 3)




**Synonyms**

*Segmentina angusta* Jickeli, 1874,

*Planorbis (Segmentina) angusta* Pallary, 1909,

*Segmentina chevalieri* Germain, 1935..

**Description**

The shell is pseudo-dextral, thin, fragile, lentiform and transparent. Underside is almost flat and the umbilicus is narrow but very deep.

Its distinguishing feature is the presence of a small partition in the last whorl, usually no more than five sets of septa. It has typically 3 to 4 rounded smooth whorls, with a distinct keel at the ventral side.

The spirally coiled whorls are increasing rapidly in size towards the aperture. The shell is umbilicated on both sides in which all whorls are visible, and the last whorl is the largest portion of the shell. The whorls are separated from each other by deep sutures. The septa and the sutures are generally more deeply impressed on both sides of the shell. There are transverse, irregular slightly curved lines of growth.

The aperture is oblique and narrow at the periphery and the upper margin is arched while the lower one is almost straight. The upper right lip is extending outwards than the lower lip and the inner lip is greatly applied to the umbilicus.

**Colour:** The colour varies from light glossy yellowish to whitish.

**Size:** The average size is 1.5 (H) x 4 mm (D).

**Habitat**

All types of muddy freshwater bodies (either harbouring vegetation or rocks) in most of tropical Africa. It is associated with different flora and fauna.

**Distribution**

**Local:** Lower and Upper Nile; Fayoum area, edge of Lake Maryut and around Max near Alexandria.

**World:** Northern limit extends from Gambia (Brown, 1980), along Lake Chad (Lévèque, 1967, Brown, 1974) to South Sudan (Longstaff, 1914; Brown, 1980) and Ethiopia (Brown, 1973).

**Status:** Rare.

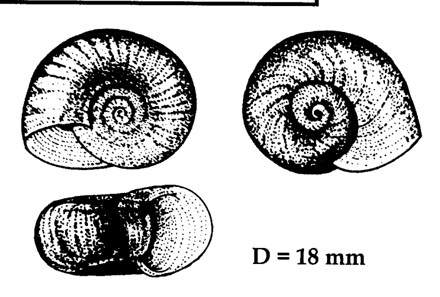
**Remarks**

*Segmentina eussoensis* (Preston, 1914) was reported to occur in Egypt (Mandahl-Barth, 1973). It has a relatively lower shell than *Segmentina angustus,* but it may be only a shell variation. Further biometric analysis is required to evaluate whether *Segmentina eussoensis* is possibly a distinct species (Brown *et al.*, 1984).

## Genus: *Helisoma* Swainson, 1840

The genus is American, and only one species, *Helisoma duryi* has been recently introduced into Egypt. The species is relatively large (9.5 x 20 mm). Whorls are strongly convex on the upper side and has a distinct angle near the suture on the under side. Growth in this genus is allometric, young specimens are proportionately very much higher than adults.

### 27. *Helisoma duryi* (Wetherby, 1879) **(Plate 3)**



**D = 18 mm**

**Synonyms**

*Planorbis duryi* Say, 1816,

*Seminolina duryi* Wetherby, 1879.

**Description**

The shell is pseudodextral and has a deep and wide umbilicus on the left side which is saucer-like, with more or less flat shallow depressed spire. The number of whorls varies from 4 to 5.

The whorls are strongly convex on the upper side and have a distinct angle near the suture on the underside. The whorls are spirally coiled increasing rapidly in size toward the aperture. The last whorl is the biggest portion of the shell and is usually subangular and somewhat more elevated than all other whorls.

The sculpture comprises slightly curved regular growth lines. The sutures are deeply impressed on the left than on right side of the shell. The aperture is suboval, slightly higher than wider with a thin sharp outer lip. The outer lip, from side view, appears slightly angular on the left side and broadly rounded on the right side.

**Colour:** The colour of the shell varies from glossy yellowish, green brownish, to glossy black.

**Size:** The average size is 7 (H) x 18 mm (D) and the height of the last whorl is 8 mm or longer.

**Habitat**

Stagnant and slowly running water. Highly associated with aquatic plants.

**Distribution**

**Local:** Lower Egypt, introduced either accidentally or for experimental biological control purposes (Yousif *et al.*,1993). More frequent in El-Qalyobyia, El-Minoufyia, El-Gharbyia and Damietta in addition to Giza. It was recorded from Lake Nasser.

**World:** North America, Saudi Arabia, Kenya and scattered localities elsewhere in Africa.

**Status:** Rare

**Remarks:** It has been suggested as a potential biological control agent for *Biomphalaria* and *Bulinus* snails.

## Genus: *Biomphalaria* Preston, 1910

The shell forms a rather thick disc with nearly equal concavities in the centre of both the upper and the lower sides. The concavity on the underside is termed the umbilicus, although it is not homologous with the umbilicus of other snails. It occurs in Africa and South America. Three species occur is Egypt.

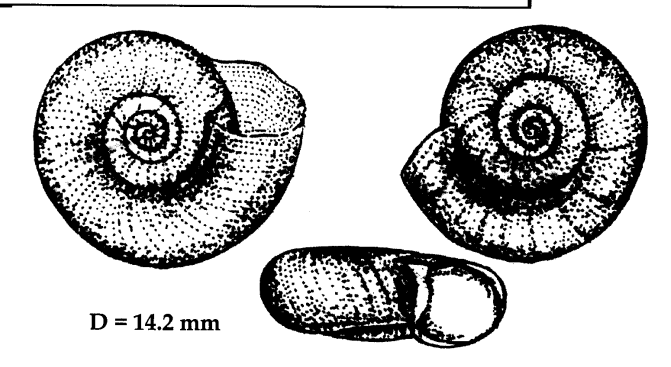
**Key to the species**

1- The whorls are rounded on the upper side apart from the last third of the ultimate whorl, which is flattened. Umbilicus is usually not much larger than height of the last whorl. Shell up to 14 mm ............................................................................***Biomphalaria alexandrina***

2- Full-grown shell consists of 4.5 to 5 rapidly increasing whorls. Umbilicus diameter is smaller than or about $^2/_3$ the height of the last whorl ........................................................................ ***Biomphalaria pfeifferi***

3- The mean number of whorls is 4.0 to 6.3. The umbilicus is deep and appears as a wide open funnel in which all whorls are visible ...................................................................................***Biomphalaria glabrata***

### 28. *Biomphalaria alexandrina* (Ehrenberg, 1831) **(Plate 4)**




**Synonyms**

*Planorbis alexandrinus* Ehrenberg, 1831,

*Segmentina* (*Planorbula*) *alexandrina* Ehrenberg, 1874,

*Planoribs* (*Menetus*) *alexandrinus* Ehrenberg, 1909,

*Planorbula alexandrinensis* Ehrenberg, 1924,

*Planorbula alexandrina* Pilsbry and Bequaert, 1927,

*Planorbis boissyi* Mandahl-Barth, 1958.

**Description**

The shell is pseudo-dextral, thin to rather thick and sometimes fragile. It is discoidal in outline, formed of spirally coiled whorls which increase gradually in diameter outwards and consist of about 5 whorls rounded at both sides.

The characteristic feature is the equality in length and parallelism of the upper and lower surfaces when viewed laterally. The shell is umblicated on the left side and has more depressed spire with a deep suture on the right side.

The sculpture includes slightly curved regular growth lines. The aperture is suboval, either carried on the line of the whorl, or projects slightly beyond it, clearly wider than high. The inner lip is closely applied to the columella. The umbilicus is open and wide and the increase in number of whorls is faster in younger snails than the older ones.

**Colour:** The colour varies from glossy in young specimens to yellowish or brownish in adults.

**Size:** The average size is 4 (H) x 13 mm (D). The diameter of the shell is about three times the height of the last whorl.

**Habitat**

Slow flowing or stagnant waters, clear or muddy. It is mostly coexisting with *Physa, Lymnaea, Cleopatra* and *Bulinus.* Also it is usually associated with many aquatic plants such as *Ceratophyllum demersum, Eichhornia crassipes, Potamogeton pectinatus, Potamogeton crispus* and *Paspalam distichum* (= *P. paspaloides*).

**Distribution**

**Local:** Along the River Nile and its tributaries from Upper Egypt to Rosetta and Damietta branches (Lower Egypt) and in Lake Nasser.

**World:** Sudan between Khartoum and Kosti (DBL, 1973). It is **endemic** to the River Nile.

**Status**: Common.

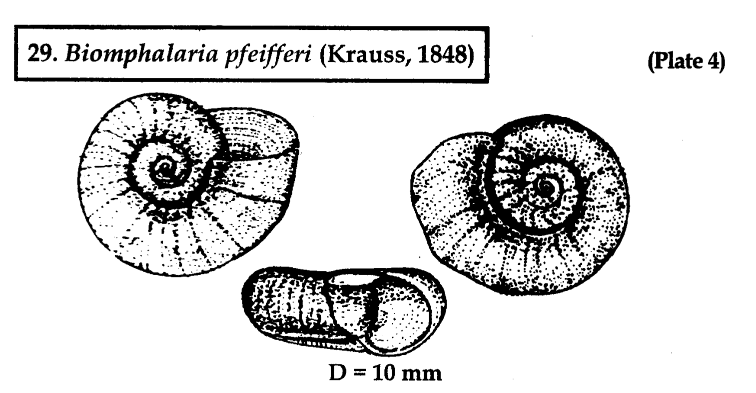
**Remarks**

It acts as an intermediate host of *Schistosoma mansoni* in Egypt. Old publications indicated that this snail was widely distributed in the Nile Delta only, while recent reports and the present survey show that it has

invaded Upper Egypt till Aswan after building the High Dam. It is also recorded from Lake Nasser as far as Abu Simbel.

*Biomphalaria alexandrina* can be infected with cercariae of the trematode *Echinostoma revolutum* and with ***Rhabditis*** **sp. a pseudoparasitic** nematode species. It can also harbour **metacercariae of *Echinostoma*** *revolutum* and *Echinoparyphium recurvatum* (**Rýsavý *et al* 1974**)

**29. *Biomphalaria pfeifferi* (Krauss, 1848)** **(Plate 4)**



**D = 10 mm**

**Synonyms**

*Planorbis pfeifferi* Krauss, 1848,

*Planorbis stanleyi* Smith, 1888,

*Planorbis bridouxianus* Bourguignat, 1888,

*Planorbis paeteli* Pallary, 1902,

*Planorbis boissyi* Potiez and Michaud: Longstaff, 1914,

*Planorbis* (*Coretus*) *adowensis* Bourguignat, 1914,

*Planorbis bridouxi* Bourguignat, 1929,

*Biomphalaria rüppellii katangae* Haas, 1934.

**Description**

The shell is pseudo-dextral, thin to rather thick, discoidal, consisting of 4 to 4.5 fast increasing whorls. The whorls are smoothly rounded, although slight indication of an angle just below the middle can be noticed. The inner whorls are more depressed on the lower (left) side than the upper (right) side.

The difference in length and parallelism of the upper and lower surfaces when viewed laterally is a characteristic feature. The shell is umblicated on the left side and has a more depressed spire with a deep

suture on the right side. The left side is saucer-like. The sculpture consists of slightly curved regular growth lines.

The aperture is suboval broader than high, and projects beyond the line of the whorl. The inner lip is closely applied to the columella. The peristome is simple and very thin.

**Colour:** The colour varies from glossy in young specimens to glossy yellowish and black in old ones.

**Size:** The average size is 13 (D) x 5.2 mm (H) and the height of the last whorl is 4.2 mm. The diameter of the greatest shell does not exceed about 11 mm. The increase in number of whorls is faster in younger snails than in older ones.

**Habitat**

All types of slowly-running permanent water bodies, but not in seasonal pools or extensive papyrus swamps. It is usually associated with *Physa, Lymnaea,* ***Bulinus*** and *Biomphalaria alexandrina* and also highly associated with aquatic plants as in case of the latter species.

**Distribution**

**Local:** Lower Egypt especially in El-Kanater El-Khiryia, El-Minoufyia and Damietta. It was known to occur in Fayoum area (Gardner, 1932) but it disappeared completely, and no one has recorded it during the last 60 years, except during the present survey.

**World:** Asmara in Ethiopia (Brown, 1965), the Nile Atbara confluence in Sudan (Malek, 1958), Jebel Marra, Lake Chad and the Senegal River (Mandahl-Barth, 1957). In the Sahara in the Tassilt N'Ajjer at Ain Kerma (*Planorbis duveyrieri,* Devilliers and Pérés, 1939) and at Tin Tahart, Algeria (*Planorbis aucipitanianus* Pallary, 1934); at Faya Largeau, Chad and at Ghat, Libya (Mandahl-Barth, 1958).

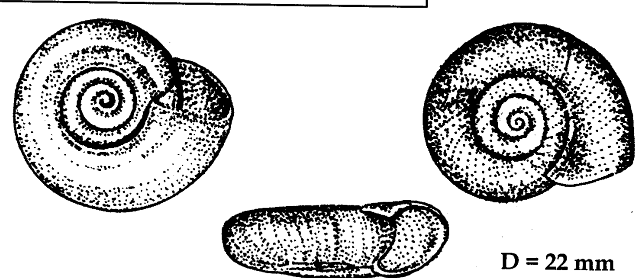
**Status:** Rare.

**Remarks**

*Biomphalaria pfeifferi* is one of the most important intermediate hosts for *S. mansoni* in Africa.

## 30. *Biomphalaria glabrata* (Say, 1818)

**(Plate 4)**




**Synonym**

*Australorbis glabratus* Say, 1818.

**Description**

The adult shell has about 5 to 6.5 whorls, increasing slowly or sometimes more rapidly in diameter. The whorls are normally rounded on the sides, though sometimes flattened, angular, or even carinate on the left and less frequent on the right.

Each side of the shell varies from broad and shallow to deeply concave, generally in inverse proportion to the opposite side. The right side may be flat or even a little convex in some individuals.

The aperature may be narrow, ovate, semicircular rounded or transverse. It is usually subangular on the lower left side, directed forward and generally oblique to the right or to the left side. The peristome is thin and continuous.

**Colour:** The colour varies from glossy in young specimens to yellowish and brownish in adults.

**Size:** The shell may reach a maximum of about 40 mm in diameter, though usually it ranges between 15 and 30 mm. The height is between 5 and 8 mm in most specimens at 20-27 mm diameter.

**Distribution**

**Local:** It has been collected for the first time in Egypt in 1982, and later confirmed during 1995 (Yousif *et al.*, 1996) from irrigation and drainage systems at Giza, Qalyoubiya and Kafr El-shiekh governorates.

**World:** It is well known in USA, Canada and South America.

**Status**: Rare

**Remarks**

It is a major intermediate host of *Schistosoma mansoni* in the new world (USA, Canada and South America). Recent studies indicate that the density of cercariae liberated from one snail is 4 to 6 times that from *Biomphalaria alexandrina* and hence considered as a new threat for schistosomasis transmission in Egypt (Yousif *et al.*, 1996).

Yousif *et al.* (1998a) recorded a hybrid of *Biomphalaria glabrata* and *B. alexandrina* where the infestation rate ranged between 71% in Fayoum Governorate, and 52% in Dakahylya Governorate. The hybrid snails and *B. alexandrina* were found differently associated with aquatic snails and plants. The hybrid snail was found variably infected with *S. mansoni*

## Subfamily: Bulininae

Sinistral, globose or higher shells. The aperture has a sharp, evenly curved outer lip and a straight, twisted or truncate columella. This subfamily is composed of two genera, but one genus is found in Egypt.

### Genus: *Bulinus* Müller, 1781

The taxonomy of the genus is difficult because of the great variability of the species, both with regards to shell characters and to anatomical features as well. So, it is often necessary to examine several specimens in order to achieve a precise identification.

Mandahl-Barth (1957) divided the genus *Bulinus* into four groups: the *B. africanus* group (subgenus *Physopsis), B. truncatus / B.tropicus* group (subgenus *Isidora), B.forskalii* group and *B.reticulatus* group (subgenus *Bulinus*).

**Key to subgenera and species**

1- Shell is turriculate with a spire higher than the aperture ........................................................................................**(Subgenus *Bulinus*)**

- Shell with a distinct shoulder angle on the upper whorls and rather distinct transverse ribs ....................................................***Bulinus forskalii***

2- Microsculpture on the upper whorls consists of transverse ribs; columella is not truncate, renal ridge is absent ........ **(Subgenus *Isidora*)**

- Shell is usually glossy, whitish to rather dark, umbilicated, globose or ovate with a spire shorter than aperture. It is 10 to 11mm high, rather narrow and without spiral lines ..................................***Bulinus truncatus***

- Shell is about 12 x 9 mm, with a low but prominent spire, rather dark and the umbilicus is relatively closed ............................ ***Bulinus guernei***
- Full grown shell is 11 to 15 mm high, globose and often with very delicate spiral lines on the upper whorls .................... ***Bulinus natalensis***

**Subgenus:** ***Bulinus***

## 31-*Bulinus* (*Bulinus*) *forskalii* (Ehrenberg, 1831) (Plate 5)

**Synonyms**

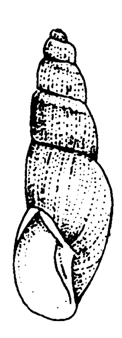
*Isidora forskalii* Ehrenberg, 1831,

*Physa wablbergi* Krauss, 1848,

*Isidora* (*Pyrgophysa*) *forskalii* Pallary, 1908,

*Bulinus* (*Pyrgophysa*) *forskalii* Pallary, 1909,

*Bulinus* (*Bulinus*) *forskalii* Mandahl- Barth, 1957.



**H = 13 mm**

**Description**

The shell is sinisteral, thin to somewhat fragile, turriculated in outline with a spire distinctly longer than the aperture, and with a blunt apex.

The whorls increase slowly and regularly in diameter towards the aperture. A shoulder angle is usually present on the brink somewhat near to upper edge of the whorls. The angulation is more distinct on the earlier whorls and less distinct towards the body whorl. The number of whorls varies from 4 to 5.

The sculpture includes large number of regularly arranged narrowly vertical ribs. There are numerous less distinct close fine vertical striations and deep sutures separating the whorls.

The aperture is elongate oval in outline. It takes the shape of the tongue. The upper and lower parts of the outer lip are nearly curved but the middle part is nearly parallel with the body whorl. The inner lip or columellar margin is twisted. The shell is not umbilicated.

**Colour:** The colour varies from light horny to yellowish with brownish colour at the upper part.

**Size:** The size varies from 11 (H) x 4.5 mm (D) to 15 x 4.8 mm.

### Habitat

It mainly lives in a great variety of natural and man-made water bodies. It is most common in small, temporary pools, and muddy rainpools lacking aquatic macrophytes.

### Distribution

**Local:** In few localities in Egypt (northern region of Delta, Fayoum Governorate), Kharga Oasis as well as Lake Nasser.

**World:** Most of Africa, the northern Gambia (Smithers, 1956), Lake Chad (Lévèque, 1967), North Nigeria, Jebel Marra, Ethiopia and Somalia (Brown, 1980).

**Status:** Rare.

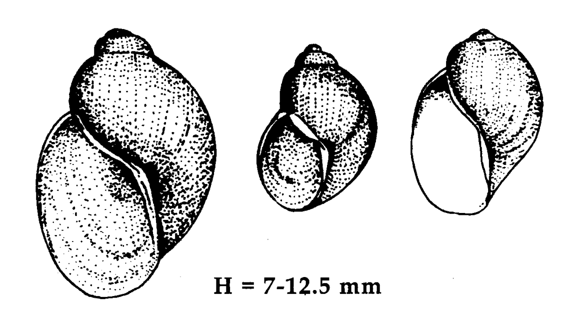
### Remarks

*Bulinus forskalii* is able to aestivate during hot months. It is a major host of *Schistosoma intercalatum, S.haematobium* and some strains of *S.bovis* (*Brown,* 1980). *Bulinus forskalii* transmits also several species of stomach flukes (Paramphistomatidae) to some ruminants.

## Subgenus: *Isidora* Audouin

Fourteen species are now considered as valid throughout the world, but only one occurs in Egypt.

### 32. *Bulinus* (*Isidora*) *truncatus* (Audouin, 1827) (Plate 5)



H = 7-12.5 mm

**Synonyms**

*Physa truncata* Audouin, 1827,

*Isidora contorta* Jickeli, 1874,

*Physa rohlfsi* Clessin, 1886,

*Bulinus (Isidora) contortus* Pallary, 1909,

*Isidora dybowskii* Longstaff, 1914,

*Bulinus contortus* Leiper, 1916.

**Description**

The shell varies in thickness from fragile, thin to rather thick. It is highly variable in shape from elongate ovate, globose to conical or subconical. The whorls are spirally coiled and somewhat flattened.

The number of whorls varies from 2.3 to 4.2. The whorls are generally convex and rounded at the periphery and are separated by a deep suture. The body whorl has a horizontal or slightly concave border and well developed shoulder. The spire is clearly shorter than the aperture and the apex varies from obtuse to rather elevated.

The sculpture is more conspicuous on the body whorl than on the earlier whorls. It includes thick transverse irregular ribs, furrows and rather coarse growth lines. The umblicus is visible and varies from small to rather big.

The aperture varies from elongate ovate to ovoid and almost round. It is limited by an outer convex lip and inner sharp columellar margin which leaves a small umbilicus between it and the surface of the shell.

**Colour:** The colour varies from light, glossy, yellowish to dark brownish.

**Size:** The size varies from 7.4 (H) x 5.5 (D) to 12.5 x 9.9 mm.

**Habitat**

All types of water bodies, including seasonal ones, clear or muddy waters, including the River Nile, lakes, lagoons, pools and canals. It is highly associated with *Lymnaea, Physa, Biomphalaria* species. It is also commonly found among the deeply floating roots of *Eichhornia crassipes, Najas marina* subsp. *armata, N.minor* and *Persicaria salicifolia* (=*Polygonum salicifolium*).

**Distribution**

**Local:** Along the River Nile and its tributaries from Lake Nasser (Upper Egypt) to Rosetta and Damietta branches (Lower Egypt).

**World:** In Africa from Lower Zaire and Tanzania northwards till the Iberian Peninsula, Sardinia, Sicily, the Near East (Arabia, Jordan, Palestine, Iran) and S.W.Arabia (Brown, 1980). It is common in Morocco, Algeria, Tunesia (Chevallier, 1969),

Libya (Itagaki & Yasuraoka, 1975), Niger (Fischer-Piette, 1948), Chad and Sudan (Malek, 1958) Ghana and East Africa (Ethiopia).

**Status:** Common.

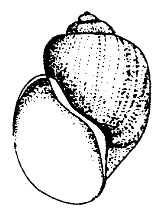
**Remarks**

*Bulinus truncatus* is the main intermediate host of *Schistosoma haematobium* in Egypt and other Middle East countries. This snail is also an important transmitter of cattle parasites such as *Schistosoma bovis* and the stomach fluke *Paramphistomum microbothrium*. *B. truncatus* can be infected with cercariae of *Echinoparyphium recurvatum*, with cercarial stages of the families Strigeidae and Paramphistomatidae, with xiphidocercaria, and with nematodes of the family Enoplidae. It can also harbour metacercariae of *Echinostoma revolutum* and *Echinoparyphium recurvatum* (Ryšavý *et al* 1974).

## 33. *Bulinus (Isidora) guernei* (Dautizenberg, 1890) (Plate 5)

**Synonyms**

*Isidora guernei* Dautizenberg, 1890,
*Isidora strigosa* Martens, 1886,
*Bulinus trigonus*Martens, 1887,
*Bulinus strigosa* Martens, 1887.



**H = 12 mm.**

**Description**

Shell is ovate, with a spire shorter than the aperture. Microsculpture on the upper whorls consists of spirally arranged short transverse lines. Columella is not truncate.

**Size:** Full grown shell is comparatively small (12 x 9 mm), with a low but prominent spire.

**Habitat**

Stagnant waters, marshes and slow-water channels; usually it is found firmly attached to vegetation.

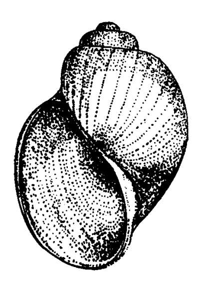
**Distribution**

**Local:** Some localities in the Delta region.

**World:** Mali, Mouritania, Lakes Albert and Victoria.

**Status:** Rare.

## 34. *Bulinus (Isidora) natalensis* (Küster, 1841) (Plate 5)



H = 13 mm

### Synonyms

*Isidora natalensis* Küster, 1841,
*Physa natalensis* Küster, 1841,
*Physa angolensis* Morelet, 1866,
*Physopsis natalensis* Haas, 1936,
*Bulinus (Bulinus) tropicus angolensis* Mandahl-Barth, 1957,
*Bulinus (Bulinus) natalensis* Mandahl-Barth, 1965.

### Description

The shell is sinistral, globose and often with very delicate spiral lines on the upper whorls. The full-grown shell is 11 to 15 mm high. Columella is not truncate. The spire is shorter than the aperture.

### Habitat

It lives mainly in a great variety of muddy, natural and man-made water bodies, lotic or lentic.

### Distribution

**Local:** Few localities in Lower Nile.

**World:** Zambia, Ghozi River, Mwadingusha Dam and Mura River.

**Status:** Rare.

## FAMILY: PHYSIDAE

Shells are small to rather large, thin or slightly thickened, sinistral, conispiral and non-umbilicate. The aperture is large, angled above and rounded below. Spire is short and the surface is smooth or with well marked microsculpture. This family is world-wide, one genus with one species occurs in Egypt and it has no medical or veterinary importance.

### Genus: *Physa* Draparnaud, 1801

This genus is abundant and world-wide in distribution. The shell is sinistral, small to medium-sized, subovate, and with or without fine spiral sculpture. *Physa* appears to be more tolerant of pollution than most other freshwater molluscs and sometimes occurs in great abundance in mild-polluted water, presumably because fish and other animals which feed on *Physa* don't live in such habitats. The genus may originally have been introduced to Europe from North America and have spread southwards to Asia and Africa. The other species occurring in Africa, *Physa marmorata* Guilding, is of caribbean origin and restricted to Ghana, Togo and Dahomey (Brown, 1980).

### 35. *Physa acuta* Draparnaud, 1805

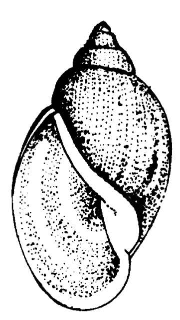
**(Plate 5)**

**Synonym**

*Physa subopaca* Bourguignat, 1864.

**Description**

The shell is sinistral, globose ovoid to elongate in outline and not umbilicated. It is thin to rather thick with a sharply pointed apex. Spirally coiled whorls are increasing slightly in height outwards. The number of whorls is about 5, which are generally convex and more rounded at the periphery and separated by deep sutures.



**H = 15 mm**

The sculpture includes microscopic striae. The shell is very glossy with smooth surface which lacks ribs. The aperture is ovoid in outline, limited by an outer delicate convex lip and the inner lip is not complete and the lower part is applied to the columella.

**Colour:** The colour varies from white iridescence, yellowish amber to brownish.

**Size:** The average dimensions are 15 (H) x 9 mm (D).

**Habitat**

Swift and slow-flowing or stagnant waters, common in streams and ponds. It is associated with most freshwater snails and some aquatic plants like *Ceratophyllum demersum, Potamogeton crispus* and *Phragmites australis*.

**Distribution**

**Local:** Along the River Nile and its tributaries from Lake Nasser (Upper Egypt) to Rosetta and Damietta branches.

**World:** In Africa, from Egypt to South Africa, usually in polluted channels. In Morocco, Algeria (Brown, 1980) and in the Mediterranean region.

**Status:** Common.

**Remarks**

It has no medical or veterinary importance. The distinguishing characters of the species from *Bulinus,* is the more sharply pointed apex, and the smoother surface without ribs.

# FAMILY: ANCYLIDAE

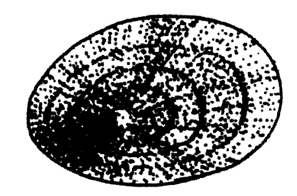
The shell is small, cap-or shield-shaped, slightly asymmetric with the apex situated to the right of the median line. The animal is sinistral with the genital opening, anus and pseudobranch are placed on the left side. The taxonomy of the African species is very unsatisfactory as far too little is known of their anatomy and a revision is clearly needed.

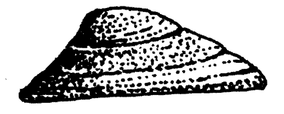
Of the three genera now occurring in Africa namely, *Ferrissia, Ancylus* and *Burnupia,* only the first one has been recorded from Egypt, but due to its small size it is usually overlooked.

## Genus: *Ferrissia* Walker, 1903

Small, flat limpets, which rarely reach 5 mm length. Apex with very fine radial ridges. Over 30 species have been described from Africa. Two species of this limpet are represented in the Lower Nile: *Ferrissia isseli* (Bourguignat), and *F. clessiniana* (Jickeli). Van Damme (1980) reported other two species in the same area which are *Ferrissia ihotellerieri* (Walker) and *F.pallaryi* (Walker). All have the same type locality: Alexandria. According to Brown (1980), many nominal African species will probably prove to be synonyms to either *F.isseli,* or to *F.clessiniana.*

## 36. *Ferrissia isseli* (Bourguignat, 1866)





**H = 1.5 mm**

**Synonym**

*Ancylus isseli* Bourguignat, 1866,

**Description**

The shell is elongate, elliptical with the anterior end slightly blunter than the posterior one. The apex is located at about one sixth of the shell length from the posterior margin and slightly to the right of the median line. Anterior to the apex, the shell is well convex. In general, the shell is comparatively high and slightly bilaterally compressed. In extreme variants, this compression can be very pronounced.

**Colour:** The shell colour is very pale brown.

**Size:** The dimensions are L = 3.7, W = 2.4 and H = 1.5 mm.

**Habitat**

On stones in rivers and brooks and restricted to coastal regions of canals on papyrus leaves and rare in lake beds.

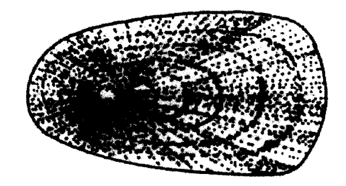
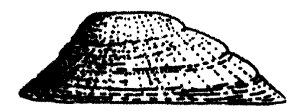
**Distribution**

**Local:** Suez and Mahmoudiah Canal and Ismailia.

**World:** Europe, Africa: in Morocco, Algeria, Tunesia and Sudan. In S.W. Arabia (Brown and Wright, 1980), Ethiopia and Kenya.

**Status:** Rare.

## 37. *Ferrissia clessiniana* (Jickeli, 1882)

**H = 1.5 mm**

**Synonyms**

Not known.

**Description**

Similar to *Ferrissia isseli,* but it is much lower and more elongated form (4.5 x 2.5 x 1.5 mm) with straight sides and broader in front than behind.

**Habitat**

Restricted to coastal regions of canals, firmly attached to vegetation.

**Distribution**

**Local:** Lower Egypt at Alexandria, Ismailia and Suez on papyrus leaves.

**Endemic** to Egypt. Not known from other countries (DBL, 1983).

**Status:** Rare.

**Remarks**

Van Damme (1988) claimed that there are two other species, restricted to Alexandria region which are *Ferrissia ihotellerieri* (Walker) and *F. pallaryi* (Walker), but no specimens have been collected during this survey.

## CLASS: PELECYPODA (BIVALVIA)

The class Pelecypoda contains approximately 210 living and extinct families. Almost all species possess calcareous bivalve shells joined together at the dorsal margin by a horny ligament. The head, radula, tentacles, and eyes are missing although tactile sensitive mantle projections and light-sensitive mantle areas may be well developed. In most families the foot is adapted for digging. Feeding is accomplished chiefly by filtering particles from the surrounding water. Fertilization is internal or external and in most species the sexes are separate. Several systems for subdividing the Pelecypoda are in use based on hinge structure, musculature and other anatomical features.

### ORDER: EULAMELLIBRANCHIA

This is the largest order of Pelecypoda and contains both marine and freshwater representatives. Eulamellibranchia are characterized by (1) a heterodont hinge containing a few hinge teeth of diverse shape and size; (2) dimyarian musculature with 2 adductor muscles anterior and posterior of about the same size; (3) the mantle is partly or completely closed and in most families has well-developed siphons and (4) leaf-like gills or ctenidia within the mantle cavity. The African freshwater bivalves belong to two groups (superfamilies); one comprising the larger species, the Unionacea, and the other including the smaller species, the Sphaeriacea.

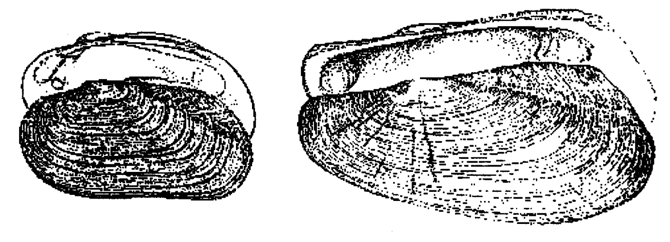
**Checklist and Status of Freshwater Pelecypods in Egypt**

| Species | Status | | |
|---|---|---|---|
| | Common | Rare | Extinct |
| **A. SUPERFAMILY: UNIONACEA** | | | |
| **Family : Unionidae** | | | |
| 1- *Caelatura* (*Caelatura*) *aegyptiaca* (Cailliaud, 1827) | * | | |
| 2- *Caelatura* (*Caelatura*) *companyoi* (Cailliaud, 1827) | * | | |
| 3- *Caelatura* (*Caelatura*) *canopicus* (Cailliaud, 1827) | * | | |
| 4- *Caelatura* (*Caelatura*) *prasidens* (Cailliaud, 1827) | * | | |
| 5- *Caelatura* (*Caelatura*) *masranus* (Cailliaud, 1827) | | * | |
| 6- *Caelatura* (*Caelatura*) *emeterus* (Bourguignat, 1883) | | * | |
| 7- *Caelatura* (*Iaronia*) *nilotica* (Cailliaud, 1827) | * | | |
| 8- *Caelatura* (*Iaronia*) *pruneri* (Bourguignat, 1883) | * | | |
| 9- *Caelatura* (*Iaronia*) *monereus* (Bourguignat, 1883) | | * | |
| 10- *Caelatura* (*Iaronia*) *gaillardoti* (Bourguignat, 1883) | | * | |
| 11- *Caelatura* (*Horusia*) *parreyssi* (Philippi, 1848) | * | | |

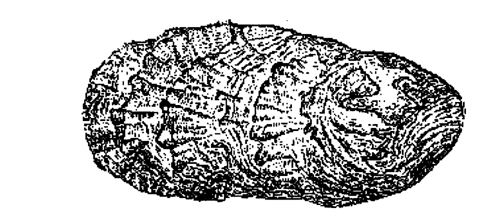
| | | | |
|---|---|---|---|
| 12- *Caelatura* (*Horusia*) *anergus* (Bourguignat, 1883) | | * | |
| 13- *Caelatura* (*Horusia*) *bourguignati* (Rochebrune, 1886) | | * | |
| 14- *Caelatura* (*Horusia*) *petrettinii* (Bourguignat, 1883) | * | | |
| 15- *Caelatura* (*Horusia*) *aenodus* (Bourguignat, 1883) | * | | |
| 16- *Caelatura* (*Nitia*) *teretiuscula* (Philippi, 1847) | * | | |
| 17- *Unio elongatulus dembeae* Sowerby, 1825 | | | * |
| 18- *Unio abyssinicus* Martens, 1866 | | | * |
| 19- *Unio fayumensis* Pilsbry & Bequaert, 1927 | | | * |
| 20- *Unio willcocksi* Newton, 1899 | | | * |
| **Family : Mutelidae** | | | |
| 21- *Mutela dubia nilotica* (Cailliaud, 1823) | * | | |
| 22- *Mutela rostrata* (Rang, 1835) | * | | |
| 23 - *Mutela singularis* (Pallary, 1924) | | * | |
| 24 - *Spathopsis rubens arcuata* (Cailliaud, 1823) | * | | |
| 25 - *Spathopsis wahlbergi hartmanni* (Martens, 1866) | | | * |
| 26- *Spathopsis wahlbergi letourneuxi* (Bourguignat, 1890) | | | * |
| **Family : Etheriidae** | | | |
| 27- *Etheria elliptica* Lamarck, 1807 | | * | |
| **B. SUPERFAMILY : SPHAERIACEA** | | | |
| **Family : Corbiculidae** | | | |
| 28- *Corbicula consobrina* (Cailliaud, 1827) | * | | |
| **Family : Sphaeriidae** | | | |
| 29- *Sphaerium (Musculium) hartmanni* (Jickeli, 1874) | * | | |
| 30- *Pisidium amnicum* (Müller, 1774) | | * | |
| 31- *Pisidium casertanum* (Poli, 1791) | | | * |
| 32- *Pisidium nitidum* Jenyus, 1832 | | | * |
| 33- *Pisidium subtruncatum* Malm, 1853 | | | * |
| 34- *Pisidium kenianum* Preston, 1911 | | | * |
| 35- *Pisidium pirothi* Jickeli, 1881 | | * | |
| 36- *Eupera ferruginea* (Krauss, 1848) | | * | |
| **Total** | **15** | **11** | **10** |

## A PICTORIAL INDEX TO FAMILIES

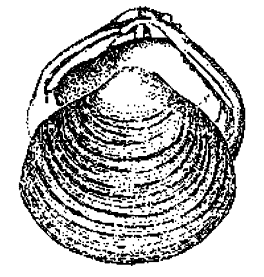
### PELECYPODS



Unionidae    Mutelidae



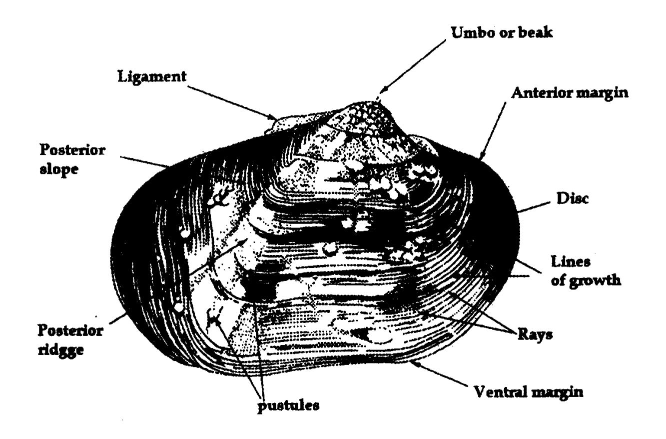
Etheriidae



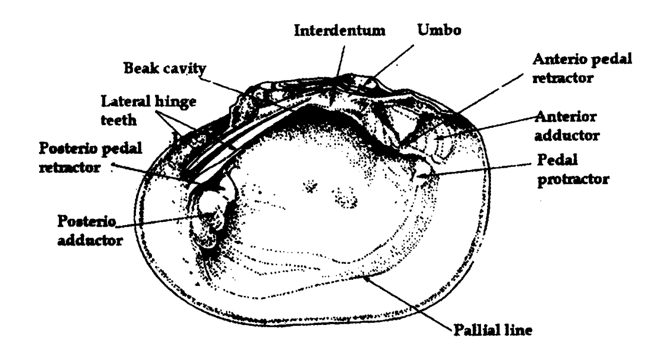
Corbiculidae



Sphaeriidae

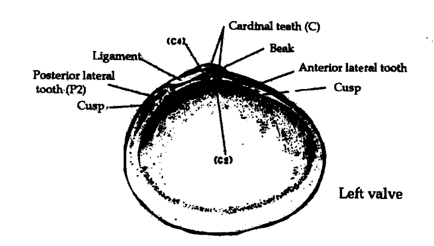



Exterior morphology of freshwater mussel shell (Right valve)

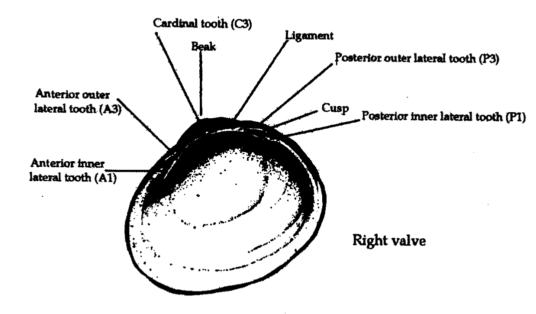



Interior morphology of freshwater mussel shell (Left valve)

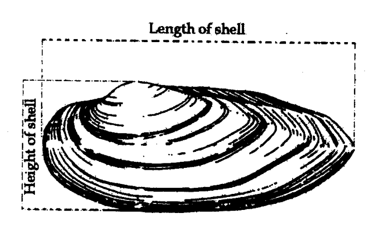
# TECHNICAL TERMS AND MEASUREMENTS



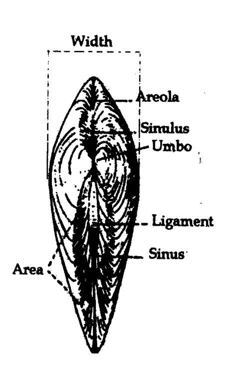

Interior morphology of the left valve of a Sphaeriidae shell (adapted from Clarke, 1973




Interior morphology of the right valve of a Sphaeriidae shell (adapted from Clarke, 1973)




Morphology of a bivalve shell (Van Damme, 1988)



## A. SUPERFAMILY: UNIONACEA

This superfamily comprises the majority of the true large freshwater bivalves. As a rule, they have the beaks placed before the middle of the shell. The hinge may be schizodont, anodont or with secondary tubercles, but never heterodont. They have a parasitic larval stage, after which they spend their lives buried in the bottom with only the posterior end protruding into the water. The superfamily contains three families (Unionidae, Mutelidae and Etheriidae); all are represented in Egypt.

**Identification Key For Unionacea Families**

1- The shell is large; length is more than 25 mm and the hinge with cardinal teeth and posterior lateral teeth. A supra-anal opening is present and the larvae are glochidia........................................ ***Unionidae***

2- Hinge is without teeth or with several small tubercles. The supra-anal opening is absent and the larvae are much more transformed than glochidia........................................................................................ ***Mutelidae***

3- Sessile, inequivalve bivalves, with one of the valves cemented to rocks or other shells............................................................................... ***Etheriidae***

# FAMILY: UNIONIDAE

Shell is small to large (1-8 inches long or more), nacreous and variously sculptured.The beak is always situated anterior to the middle of the shell, and its sculpture is variable but basically concentric. The hinge of the left valve has typically two cardinal teeth and two long, lamellate lateral teeth, while that of the right valve has only one cardinal tooth and one lateral tooth, but an accessory cardinal tooth is frequently developed in the right valve, and in some species also an additional lateral tooth is present.

As in other Unionacea, the eggs are stored and fertilized in the gills, where they also develop and hatch to a special larval stage called the glochidium. The glochidium larvae in nearly all species are parasitic on fishes for few days or weeks after emergence from the parental marsupium. All Unionidae are phytophagous and filter-feeders. The family comprises nearly one hundered genera with the majority living in North America and Eastern Asia. The taxonomy of the African Unionidae is not yet fully elucidated, and the number of accepted genera varies among different authors. The unionids of Egypt are confined to two genera; *Caelatura* and *Unio.*

**Key to the local genera of Unionidae**

1- Hinge with well developed teeth, umbonal sculpture of adult shells consisting of distinct zigzag lines ................................................ ***Caelatura***

2- Cardinal anterior teeth are rather thin and not forming a distinct angle to the hinge plate. Lateral teeth are normally developed. Umbonal sculpture of adult shells, if present consists of few rows of tubercules or concentric folds. Shell is oval or oblong ....................................... ***Unio***

### Genus: *Caelatura* Conrad, 1853

The shell is of medium size, about 45 mm in length, usually elliptical, compressed or more inflated, and often with, a more or less, pustulous zigzag sculpture, sometimes restricted to the beaks, but frequently covering a greater part of the valves.

Earlier, more than 200 supposed species and subspecies have been described, and more than half of them by École Nouvelle in France, who claimed that differences in the three dimensions: length, height and diameter between two bivalves made it necessary to .separate them as distinct species. This idea resulted in a great number of "new" species established on young shells (Mandahl-Barth, 1988). But, Pallary (1924) had classified the genus into four "sections", which are **Caelatura, Iaronia, Horusia** and **Nitia.** His classification depends on the shape of the valves,

characters of the teeth and the colour of the nacre. Later, Mandahl-Barth (1988), after studying much material, reduced all the species of the first 3 sections into only one species; *Caelatura aegyptiaca*, and all the species of the fourth section into *Caelatura teretiuscula*. Also, he reported that all the different forms of *C. aegyptiaca* can be categorized into 3 fundamental forms: *aegyptiaca* form (Caelatura section), *nilotica* form (Iaronia section) and *parreyssi* form (Horusia section). But, at the end of his study, Mandahl-Barth (1988) was not completely convinced about his classification, and he said "it is still an unsolved question whether these fundamental forms are entirely phenotypic, but it seems likely that also genetic factors are involved, because different forms can be found in the same locality". On the other hand, Van Damme (1988) took into account the classification of Pallary (1924), but he considered the sections as subgenera, and reduced many species under these subgenera.

In the present study, we followed Van Damme (1988) classification, but taking into consideration all the species which have been mentioned by Pallary (1924), without reducing many of them. But, in fact a thorough genetical study is needed on the different species or forms of the genus *Caelatura* to solve this problem.

**Key to the subgenera of genus *Caelatura***

1- The shell is thin and has long and slender lamellate cardinal teeth and frequently there is an angle between the dorsal and the anterior margin. Sometimes the dorsal margin becomes more oblique and the shell is relatively higher ................................................................ ***Caelatura***

2- The shell is fairly strong and has rather short cardinal teeth. A zigzag sculpture may be present on the beaks, but usually only in young specimens, in which also oblique ridges may be present on the area and the areola ...................................................................................... ***Iaronia***

3- The shell is strong and the lower valve has much stronger cardinal teeth. The zigzag sculpture is frequently more pronounced ..... ***Horusia***

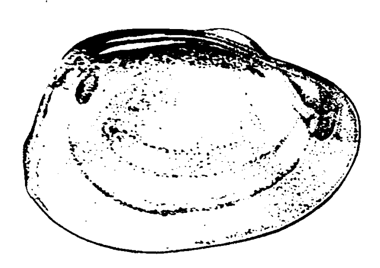
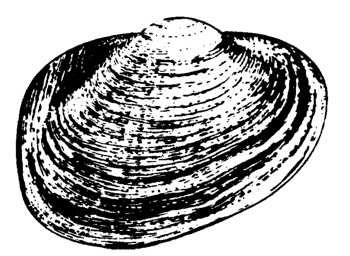
4- The shell is much longer, twice as long as high or longer. The type specimen is 44 x 17.5 x 15 mm. The hinge is rather of *Horusia* subgenus; the cardinal teeth are compressed, but the upper additional cardinal tooth of the right valve is weaker and the lower is relatively stronger. A particular sculpture is absent........................................................... ***Nitia***

**A- Subgenus Caelatura**

Only one extremely polymorphic representative of this subgenus occurs in Egypt. The shell is thin, nacre with bluish to white iridescence. The cardinal teeth are lamellate.

## 1. *Caelatura (Caelatura) aegyptiaca* (Cailliaud, 1827)

(Plate 6)

L = 35 mm

**Synonyms**

*Unio aegyptiacus* Cailliaud, 1827,
*Unio niloticus* Cailliaud, 1827,
*Unio parreyssi* Philippi, 1848,
*Nodularia aegyptiaca* Fér. 1874,
*Unio essoensis* Chaper, 1885,
*Nodularia lacoini* Germain, 1905,
*Unio lacoini* Germain, 1906,
*Unio chivoti* Germain, 1907,
*Caelatura aegyptiaca* Pilsbry and Bequaert, 1927.

**Description**

Shell is extremely variable. The basic riverine form is ovoid, more thin-shelled, rhomboidal in shape, subinflated, subinequilateral, fuller behind the middle and broader posteriorly than anteriorly with a straight to slightly curved posterior end.

The umbo is a small swollen knob which is found nearly at the mid dorsal point slightly protruding over the dorsal margin. It represents the apex or the oldest part from which growth of the valves has proceeded. The two valves are connected with less elastic light brownish coloured hinge ligament, placed at the posterior dorsal margin. Posterior slope compressed and somewhat alate in young specimens. The sculpture includes regular growth lines with vertical faint rays from the umbo to the shell with double-looped beak sculpture.

Insertions of muscles appear as roughened areas on the smooth inner surface. They include the anterior and posterior adductors, the anterior and posterior retractors and the protractor muscle insertions. The insertions of the anterior adductor are more distinct and deeper than the posterior ones.

The hinge plate is denticulate of the heterodont type. It contains cardinal lamellate teeth and lateral teeth. The cardinal teeth include 2 lamellate teeth on the left valve, one long elevated slightly serrated and a second small elevated and triangular in shape. The first one is articulating with 2 parallel lamellate teeth on the right valve. Between them there is a deep depression. The lower tooth is more elevated than the upper one, and leaves an impression under the first tooth, but the second tooth lies behind the two cardinal teeth of the right valve in the beak cavity. Lateral teeth are slightly curved, thin, and well developed. There is one in the right valve and two in the left valve.

**Colour:** The colour of the outer shell (periostracum) varies from light greenish, brownish or yellowish colour. Interiorly, each valve is smooth with a red iridescent nacre or light transparent in juvenile.

**Size:** The average size is about 35 (L), 23.5 (H), 15 (W) mm.

**Habitat**

This clam inhabits sandy or sand-muddy bottom, muddy islands and pools on the sides of the Nile and its main canals. It is common in stagnant or slowly running water.

**Distribution**

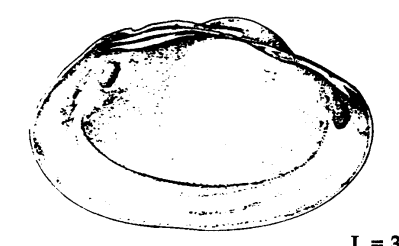
**Local:** Along the River Nile and its main canals from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

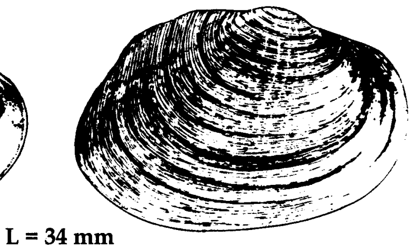
**World:** Large rivers and lakes of tropical Africa. In the Nile: Lake Albert, Lake Edward basin (Mandahl Barth, 1954; 1982) and in Lake Tanganyika (Leloup, 1951). Also in the Blue Nile at Soba (Preston, 1914). Towards the west in Lake Chad, Lake Lirè, the Chari River (Lévéque, 1967), in the Niger and Senegal Rivers (Hass, 1969).

**Status:** Common.

## 2. *Caelatura (Caelatura) companyoi* (Cailliaud, 1827)

**(Plate 6)**





**L = 34 mm**

### Synonyms

*Unio companyoi* Cailliaud, 1827,

*Nodularia* (*Caelatura*) *companyoi* (var. *shambiensis*) Longstaff, 1914.

### Description

Shell is ovoid in shape, varies from very thin to moderately thin in small specimens at a length until 40 mm, to thick in specimens more than 50 mm in length, subinflated, fuller behind the middle, truncated posteriorly but highly circular anteriorly with a circular ventral margin. It is compressed dorso-posteriorly. The shell is broader posteriorly so the height is placed posteriorly, narrowed anteriorly and prow-like with a winged posterior slope.

The umbo is rather a big swollen knob which is nearly placed at the mid dorsal margin. It protrudes slightly over the dorsal margin. The hinge ligament is less elastic in small specimens, more elastic in old ones. It has a brownish colour. The sculpture includes regular concentric growth lines, more visible in old specimens with visible oblique striations on the posterior slope. Beak sculpture includes double looped nodules parallel with the growth lines.

The hinge plate is denticulate of heterodont type. It contains cardinal and lateral teeth. The cardinal teeth include one elevated lamellate tooth in juvenile, and medium specimens, and a thick irrigular tooth in the left valve which is divided and appears as two teeth. Two parallel teeth are sloped anteriorly, being lamellate in young specimens and thick in old ones. These teeth are united posteriorly; leaving between them a deep depression, as an impression behind the cardinal right teeth at the umbonal cavity. The lateral teeth include two parallel teeth in the left valve sloping posteriorly and united anteriorly. There is a deep depression in between the lateral teeth of the left valve, while in the right

valve there is a long tooth sloped posteriorly and curved anteriorly. The tooth is broader posteriorly and narrowed anteriorly.

**Colour:** The colour varies from greenish, dark yellowish to dark brownish with alternative greenish and yellowish bands ranging from broadened bands in juvenile to narrow bands in medium and old specimens. These bands are less visible in old specimens. Interiorly, each valve is smooth with blue lustrous iridescence in young to white lustrous iridesence in medium and old specimens.

**Size:** The average size is 34 (L), 23 (H) and 14 (W) mm and the ligament length is 11 mm.

**Habitat**

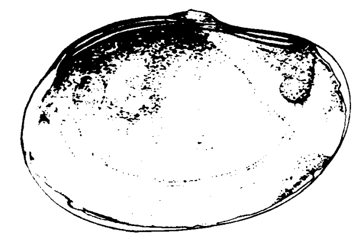
It occurs in sand-muddy bottom and pools on both sides of the River Nile. It is common in stagnant or slowly running water.

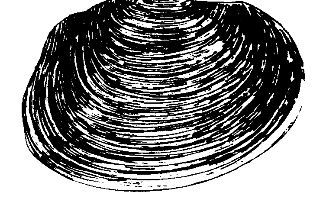
**Distribution**

**Local:** In Lower Egypt, Rosetta and Damietta branches of the River Nile.

**Status:** Common.

### 3. *Caelatura (Caelatura) canopicus* (Cailliaud, 1827) **(Plate 7)**





**L = 44 mm**

**Synonyms**

*Unio canopicus* Cailliaud, 1827,

*Nodularia* (*Caelatura*) *aegyptiaca* (var. *shambiensis*) Longstaff, 1914.

**Description**

Shell is rhomboidal in shape, varies from thin in juvenile to rather thick in old specimens. The shell is sub-inflated posteriorly, compressed dorsoventrally, sub-truncated posteriorly with a circular anterior margin and ovoid ventrally and somewhat alate. The broadness of the shell posteriorly is nearly as anteriorly keeping the height at the mid-dorsal point.

The umbo is rather a big swollen knob, placed at the mid-dorsal point. It slightly protrudes over the dorsal margin. The hinge ligament is small, less elastic in young, more elastic in old specimens. It has a light brownish colour. The sculpture includes in addition to the regular growth lines, double looped nodulous beak sculptures.

The insertions of the anterior adductors are slightly deeper than the posterior ones but less deeper than in *Caelatura (Caelatura) companyoi*. There are many irregular nodules on the smooth inner surface, but not as a specific character.

The hinge plate is denticulate of heterodont type. It contains cardinal and lateral teeth. The cardinal teeth include 2 elevated teeth in the left valve; the first anterior one is rather long, anteriorly serrated and the second posterior one appears as a triangular projection. In the right valve, 2 parallel lamellate teeth appear; the upper one is more extended anteriorly than the lower one. They are united posteriorly. The lateral teeth include 2 parallel lamellate teeth in the left valve. They are slightly curved, leaving between them a deep depression. They are united anteriorly but in the right one, there is a curved lamellate tooth, broadened posteriorly and narrowed anteriorly.

**Colour:** Periostracum varies from greenish to brownish with dark and light narrow and wide alternative green bands. Interiorly, each valve is smooth with red iridescence.

**Size:** The average size is 44 (L), 31.5 (H), 17.5 (W) mm, and ligament length is 11.5 mm.

**Habitat**

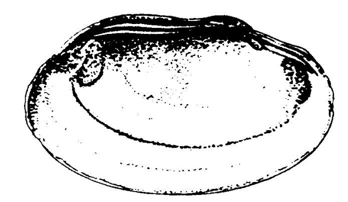
It occurs in sand-muddy bottom and pools, on both sides of the River Nile. It is common in stagnant or slowly running water and associated with *Caelatura* (*Caelatura*) *companyoi*.

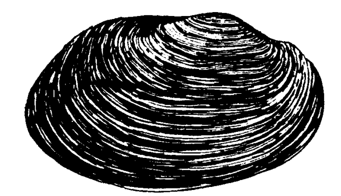
**Distribution**

**Local:** In Lower Egypt, Rosetta and Damietta branches of the River Nile.

**Status:** Common.

## 4. *Caelatura* (*Caelatura*) *prasidens* (Cailliaud, 1827) (Plate 7)





**L = 40.5 mm**

**Synonyms**

*Unio prasidens* Cailliaud, 1827,

*Nodularia* (*Caelatura*) *aegyptiaca* (var. *shambiensis*) Longstaff, 1914.

**Description**

The shell is rather long ovoid in shape, thin to rather thick in old specimens, light, inflated behind the middle and broader posteriorly than anteriorly so that the height lies at the posterior end. The posterior slope is obliquely truncated compressed and somewhat alate, but it is narrower anteriorly, round with evenly ovoid ventral margin.

The umbo is a small swollen knob, located more anteriorly than posteriorly. It slightly protrudes over the dorsal margin. The hinge ligament is an elastic cord brownish in colour.

The sclupture includes regular growth lines with distributed greenish rays from the umbo to the rest of the shell. Beak sclupture includes single or double looped sculpture. At the posterior slope, there are many parallel oblique distinct striations. There are some irregular deep notches in the nacre's surface. They may be collected in one line or distributed, but not a significant character.

The hinge plate is denticulate of heterodont type. It contains cardinal lamellate and lateral teeth. The cardinal teeth include 2 lamellate teeth in the left valve; the first one is rather long and placed anteriorly elevated, and the second one is small angled upward, triangular in shape. The first one is articulating with 2 parallel lamellate teeth, opened anteriorly and closed posteriorly in front of the umbo in the right valve. In between the two teeth, there is a deep depression. The second tooth is articulating or its anterior angle fits into a deep depression, just behind the two lamellate teeth of the right valve, and in front of an elevation like

tooth at the area of the beak cavity. The lateral teeth include one elevated curved tooth in the right valve which broadens posteriorly and narrows anteriorly articulating with two elevated curved teeth in the left valve. They are parallel, wide posteriorly but narrowed anteriorly.

**Colour:** The colour of the outer shell (periostracum) varies from greenish to brownish colour, with light greyish umbo. Interiorly, each valve is smooth with red iridescent nacre.

**Size:** The average size is 40.5 (L), 24 (H), 16.5 (W) mm and the ligament length is 13 mm.

**Habitat**

It is common in muddy or sand-muddy bottom and pools, stagnant or slowly running water.

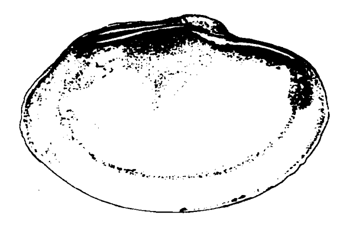
**Distribution**

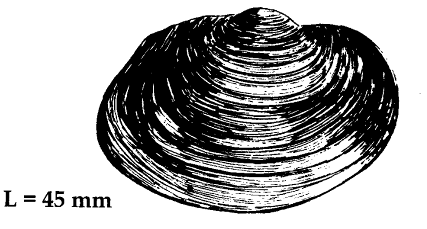
**Local:** Lower Egypt, Rosetta and Damietta branches of the River Nile and its main canals especially in pools on both sides.

**Status:** Common.

## 5. *Caelatura* (*Caelatura*) *masranus* (Cailliaud, 1827)

**(Plate 8)**





L = 45 mm

**Synonyms**

*Unio masranus* Cailliaud, 1827,

*Nodularia* (*Caelatura*) *aegyptiaca* (var. *shambiensis*) Longstaff, 1914.

**Description**

The shell is extremely variable. It varies from thin in juvenile to rather thick in old specimens. It is ovoid, subinflated, fuller behind the middle and broader posteriorly than anteriorly, so that the height lies at the posterior end. The posterior margin is subtruncate, but the anterior end is narrowed, prow-like to evenly rounded, with a distinct circular ventral margin. Posterior slope is compressed and somewhat alate.

The umbo is a small swollen knob, found more anteriorly than posteriorly, slightly protruding over the dorsal margin. The hinge ligament is elastic and brownish in colour. The sculpture includes distinct regular growth lines with distributed faint rays from the umbo to the rest of the shell. The insertions of the anterior adductors are more distinct and deeper than the posterior ones.

The hinge plate is denticulate, of the heterodont type, and contains cardinal lamellate teeth and lateral teeth. The cardinal teeth include one long lamellate tooth in the left valve, which divides it into two unequal parts. The first part is the longer, articulating with two parallel teeth, in between them lies a deep insertion in the right valve. The second part is smaller and articulating into the beak cavity area behind the two parallel teeth of the right valve. The lateral teeth include one long curved tooth in the right valve, broader posteriorly than anteriorly, articulating with two parallel curved teeth.

**Colour:** The colour of the outer shell (periostracum) varies from greenish to brownish and greyish. Interiorly, each valve is smooth with blue iridescent nacre.

**Size:** The average size is about 45(L), 30.5(H), 19.5 (W) mm and the ligament length = 12mm.

**Habitat**

It occurs in muddy or sand-muddy bottom and common in stagnant or slowly running water.

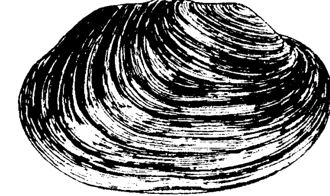
**Distribution**

**Local:** Lower Egypt along Rosetta and Damietta branches of the River Nile and main canals especially in pools on both sides.

**Status:** Rare

## 6. *Caelatura* (*Caelatura*) *emeterus* (Bourguignat, 1883) (Plate 8)







L = 39 mm

### Synonym

*Unio emeterus* Bourguignat, 1883.

### Description

The shell is thin to rather thick, elliptical, subovate, compressed dorsoventrally and subinflated. The posterior margin is subtruncate with a rounded anterior margin. The dorsal and ventral margins are nearly parallel and the posterior end is broader than the anterior one, so the height is placed posteriorly and the shell is alate.

The umbo is a small swollen knob, prominent and more anteriorly placed than posteriorly. It slightly protrudes over the dorsal margin of the two valves which are connected by rather a long brownish elastic cord, the hinge ligament.

The sculpture includes distinct regular growth lines which are very narrow posteriorly with oblique zigzag ridges on the area. The beak sclupturing consists of numerous bars each with a shallow central sinuation. It is parallel with the growth lines. The insertions of the anterior adductors are deeper than those of the posterior ones.

The hinge plate is denticulate, of heterodont type. It contains cardinal and lateral teeth. The cardinal teeth include two lamellate teeth, the first anterior one is rather long, serrated broadened anteriorly and narrowed backward. The second posterior one is rather small rounded, and there is an impression under the first anterior one. In the right valve, there are 2 parallel teeth; the upper one is rather thin and slightly elevated, while the second one is highly elevated, serrated and sloped towards the anterior margin and in between them there is a deep depression.

The two lateral teeth are parallel and curved posteriorly. The lower one is more extended than the upper one and united anteriorly with a deep depression in between them. In the right valve, there is a long tooth sloped and elevated posteriorly and narrowed anteriorly.

**Colour:** Periostracum is olive greenish, with greenish rays that narrow dorsally and widen ventrally. They are distributed allover the shell. The posterior slope is darker than the rest of the shell. Interiorly, each valve is smooth with white lustrous iridescence.

**Size:** The average size is 39 (L), 24 (H), 16.5 (w) mm, and the ligament length = 11.5 mm.

**Habitat**

It occurs in slowly running and stagnant water with sandy and sand-muddy bottom.

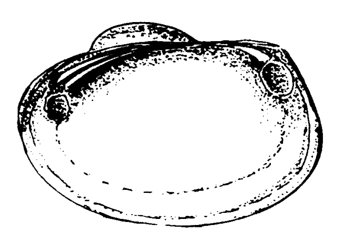
**Distribution**

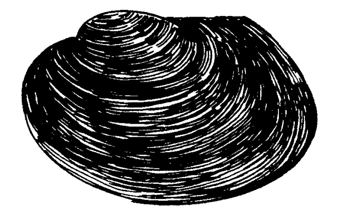
**Local**: Lower Egypt, El-Kanater El-Khairia and along the River Nile.

**Status:** Rare.

### B- Subgenus *Iaronia*

**7. *Caelatura* (*Iaronia*) *nilotica* (Cailliaud, 1827)** **(Plate 9)**





**L = 44 mm**

**Synonyms**

*Unio niloticus* Cailliaud, 1827,

*Nodularia* (*Caelatura*) *nilotica* Pallary, 1909,

*Nodularia nilotica* Simpson, 1914,

*Unio* (*Iaronia*) *niloticus* Pallary, 1924.

**Description**

It is a fairly regular oval and strong clam. The dorsal and ventral margins of the shell are almost parallel, subinflated and fuller behind the middle. It is broader posteriorly than anteriorly, so that the height is placed posteriorly. The anterior end is narrowed prow-like to evenly rounded, and the dorsal line is curved. Basal outline is curved with moderately compressed posterior slope and the posterior margin is slightly curved to subtruncated.

The umbo is a small swollen knob, more prominent and more anteriorly placed than in *Caelatura aegyptiaca.* The hinge ligament is an elastic tough strong and dark brownish in colour.

The sculpture includes stronger regular concentric growth lines with the annual lines poorly defined. The vertical rays are faint in old clams, but are distinct in young ones. Also a zigzag sclupture is present on the beaks in young specimens, in which also oblique ridges may be present.

The anterior muscle insertions are deeper than the posterior ones and also deeper than that of *Caelatura aegyptiaca.* The hinge plate is denticulate, of heterodont type. It contains cardinal and lateral teeth. The cardinal teeth are well developed, narrow and directed forward. There are two in the left valve, the first one is irregular while the second is anchored upward, triangular in shape, leaving a deep depression between them. The first tooth is articulating with two well developed parallel teeth in the right valve. The interdental projections in the left valve are articulating with an interdental depression in the right valve and the second tooth is articulating under the interdentum into the beak cavity. Lateral teeth are long well developed, slightly straight and curved posteriorly. The two teeth in the left valve are narrowed anteriorly and united just at the pre-umbonal area, but wider posteriorly. The lower tooth is slightly longer than the upper one with a deep depression in between them. In the right valve, there is one elevated tooth narrowed anteriorly but wider posteriorly. It is articulating with the interdental depression of the left valve.

**Colour:** The colour of the outer shell (periostracum) varies from greenish, brownish to dark greyish. Interiorly, each valve is smooth with blue or white lustrous iridescence.

**Size:** The average size is 44 (L), 28 (H), 20 (W) mm and the ligament length = 18 mm.

**Habitat**

All kinds of water bodies including slowly, fast running and stagnant water, especially in pools on both sides of the River Nile and its main canals. It inhabits sandy, muddy-sand or sand-muddy bottoms and in islands inside in the River Nile.

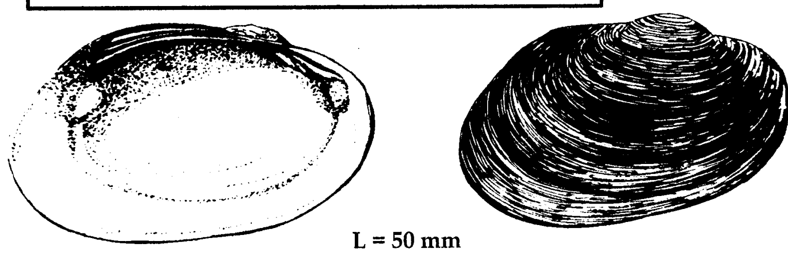
**Distribution**

**Local**: Along the River Nile and its main canals from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

**Status:** Common.

## 8. *Caelatura (Iaronia) pruneri* (Bourguignat, 1883)

(Plate 9)



L = 50 mm

**Synonym**

*Unio (Iaronia) pruneri* Bourguignat,1883.

**Description**

It has a fairly strong heavy shell. The dorsal and ventral margins are almost parallel, elongate ovate or elongate elliptical, subinflated and fuller anterio-posteriorly. The shell is slightly broadened posteriorly than anteriorly, so that the height is placed posteriorly. Anterior end is narrowed with a straight anterior margin at the disc area which is slightly curved upward and downward. Dorsal line is slightly curved, with moderately compressed posterior slope and the posterior margin is curved to subtruncated.

The umbo is rather a big swollen knob, prominent and more anteriorly placed than in *Caelatura aegyptiaca*. It is protruding over the dorsal margin. The hinge ligament is elastic tough and dark brownish in colour.

The sculpture includes concentric smooth regular growth lines and some oblique ridges. Double looped V-shaped beak sculpture is present with elevated pustules.

The hinge plate is denticulate, of the heterodont type. It contains hard cardinal teeth and thick lateral teeth. The cardinal teeth include two well developed ones directed forward in the left valve. The first anterior one is rather big, more broadened anteriorly with distinct striations on the upper curved surface and pointed posteriorly. The second tooth is small trianglar and point anchored. Two well developed parallel teeth, are present, united posteriorly and curved anteriorly. The upper one is less elevated and extending more anteriorly than the lower one which is broader and more elevated than the upper one. In between them, there is a deep depression. As a consequence, the interdental projections in the left valve are articulating with the interdental depression of the right valve. The lateral teeth include a well developed tooth in the right valve. It is broadened curved posteriorly and pointed anteriorly. It is articulating with two well developed teeth in the left valve, which are parallel curved, broadened posteriorly and narrowed anteriorly.

**Colour:** The colour of the outer shell (periostracum) varies from greenish, to brownish with vertical brownish rays. Interiorly, each valve is smooth with red iridescence.

**Size:** The average size is 50 (L), 30 (H), 20 (W) mm and the ligament length is 20 mm.

**Habitat**

All kinds of water bodies including slowly, fast running and stagnant water either with muddy-sand or muddy bottom.

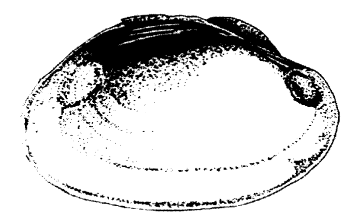
**Distribution**

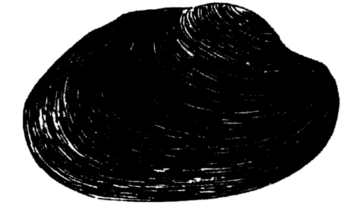
**Local:** Lower Egypt, Rosetta and Damietta branches of the River Nile.

**Status:** Common.

## 9. *Caelatura* (*Iaronia*) *monereus* (Bourguignat, 1883)

**(Plate 10)**





**L = 48 mm**

**Synonym**

*Unio* (*Iaronia*) *monereus* Bourguignat, 1883.

**Description**

The shell is very hard, thick, subovoid, inflated and compressed dorsoventrally. It is prow-like to evenly rounded. Anterior margin has an alate posterior slope, and the curved posterior margin has a pointed posterior end. Also the posterior dorsal margin is sloped with a slightly curved ventral margin. There is an angle between the anterior and dorsal margins. Posteriorly, it is broader than anteriorly, so the height is placed posteriorly.

The umbo is a big swollen knob, prominent and anteriorly placed. It has a distinct protrusion over the dorsal margin. The hinge plate is an elastic tough cord, dark brownish in colour.

The sculpture includes in addition to the concentric smooth regular growth lines, oblique ridges on the area and areola. The muscle insertions of the anterior adductor are deeper than the posterior ones of each valve.

The hinge plate is denticulate, of heterodont type. It includes cardinal and lateral teeth. The cardinal teeth include well developed hard teeth in the left valve, one is pointed elevated forward and the second is slightly angled upward. In the right valve, there are two parallel teeth united posteriorly, the lower one is more elevated and broader than the upper one which is more extended anteriorly. The lower tooth is also sloped downwardly and in between the two teeth there is a big depression.

The lateral teeth include two highly curved teeth in the left valve. They are parallel posteriorly but closed or united anteriorly with a small depression between them. The right valve is provided with a long curved tooth broadened posteriorly and narrowed anteriorly.

**Colour:** Periostracum has greenish, to brownish colour with narrow to wide green rays, which are generally distributed over the entire shell. Interiorly, each valve is smooth with blue or red iridescence.

**Size:** The average size is 48 (L), 29 (H), 17.5 (W) mm and the ligament length = 17.5 mm.

**Habitat**

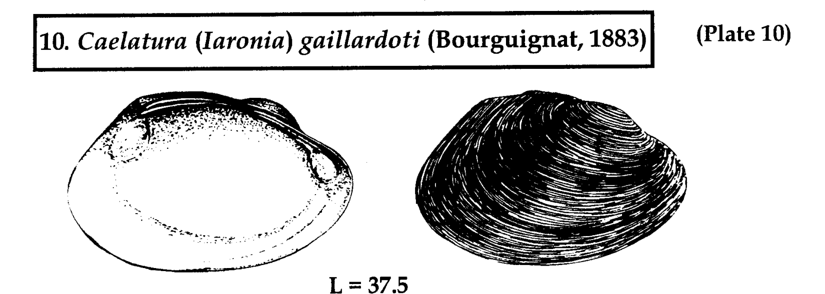
It occurs in sandy, sand-muddy bottom or pools on both sides of the Nile and its main canals, with all kinds of water bodies including slowly or fast running and stagnant water.

**Distribution**

**Local:** Along the River Nile and its main canals from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

**Status:** Rare.

**10. *Caelatura (Iaronia) gaillardoti* (Bourguignat, 1883)** **(Plate 10)**



L = 37.5

**Synonyms**

*Unio (Iaronia) gaillardoti* Bourguignat, 1883,

*Nodularia (Caelatura) gaillardoti* Pallary, 1909.

**Description**

The shell is fairly large, rather thick and solid subelliptical, subovate, swollen posterio-ventrally and somewhat alate. It is broader posteriorly than anteriorly, so that its height is placed posteriorly. The anterior end is very narrow and somewhat rounded. The posterior slope is compressed, and the posterior margin is subtruncated with evenly rounded ventral margin and a curved posterior dorsal margin.

The umbo is a small swollen knob placed anteriorly, and slightly protruding over the dorsal margin. The hinge ligament is an elastic strong dark brownish cord. It is rather short in comparison with the other species.

The sculpture includes distinct smooth regular growth lines with some oblique ridges on the area and areola. Beak sculpture is variable, but in most specimens is rather coarse and double looped elevated and nodulous. The hinge plate is denticulate and of heterodont type. It contains hard cardinal and lateral teeth. The cardinal teeth are well developed, narrow and directed forward. Two nearly equal triangled teeth are present in the left valve, slightly serrated and pointed with striations on the upper surface of each one. In the right valve, there are two parallel unequal teeth, united posteriorly. The upper one is extended anteriorly but the lower one is more elevated and anchored anteriorly. There is a depression just behind the two teeth of the right valve into the beak cavity. The lateral teeth are two well developed curved teeth in the left valve. They are broadened posteriorly but narrow anteriorly with a deep depression between them. In the right valve, there is a curved tooth broadened posteriorly but narrowed anteriorly.

**Colour:** Priostracum is shiny, greenish to light greyish in colour, with narrow to wide green rays and generally distributed over the entire shell. Interiorly, each valve is smooth with red iridescence in young and blue iridescent or sky lustrous in old specimens.

**Size:** The average size is 37.5 (L), 27.5 (H), 15 (W) mm and the ligament length = 13 mm

## Habitat

All kinds of water bodies including slowly, fast running and stagnant water. It occurs in muddy-sand or muddy bottom of pools on both sides of the River Nile and its main canals.

## Distribution

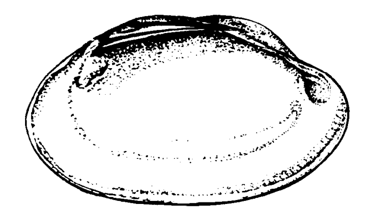
**Local:** Lower Egypt, Rosetta and Damietta branches of the River Nile.

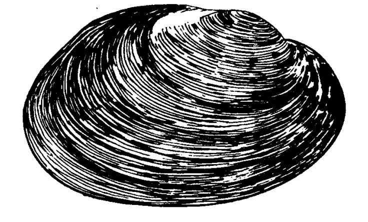
**Status:** Rare.

## C- Subgenus: *Horusia*

### 11. *Caelatura* (*Horusia*) *parreyssi* (Philippi, 1848)

**(Plate 11)**





**L = 43 mm**

## Synonyms

*Unio parreyssi* Philippi, 1848,

*Nodularia* (*Caelatura*) *parreyssi* Pallary, 1909,

*Nodularia* (*Caelatura*) *sobaensis* Preston, 1914,

*Unio parreyssi* var. *petrettinii* Pallary, 1924.

## Description

The shell is stout ovoid, truncated posteriorly, more rounded anteriorly with a curved ventral margin. It is compressed dorsoventrally and subinflated. The dorsal margin is nearly straight, and broader posteriorly than anteriorly, so the height is placed posteriorly.

The umbo is a small swollen knob, anteriorly placed and less prominent. It protrudes slightly over the dorsal margin. The hinge ligament is a tough dark brownish and elastic cord.

The sculpture includes regular distinct concentric growth lines in addition to oblique ridges. The beak sculpture is double looped nodulous, forming two short radial rows of nodules.

The hinge plate is denticulate of heterodont type. It includes hard cardinal teeth and well developed lateral teeth. The cardinal teeth include two strong teeth in the left valve, which are elevated thickened triangular, enclosing between them a depression. The right valve has two parallel teeth, the upper one is slightly elevated and the lower one is strong highly elevated, serrated and sloped downward.

The lateral teeth include two well developed teeth. In the left valve, they are highly curved, parallel broader posteriorly and narrow anteriorly until united. In the right valve, there is a well developed curved tooth, broader posteriorly and narrow anteriorly.

**Colour:** The colour of the outer shell (periostracum) varies from brownish, to blackish with a rosey beak area. Interiorly, each valve is smooth with red iridescence and the border with blue iridescence.

**Size:** The average size is 43(L), 29.5(H), 20(W) mm and the ligament length = 18 mm

**Habitat**

Swiftly running water especially with hard bottom of sand or gravel.

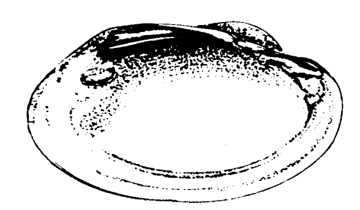
**Distribution**

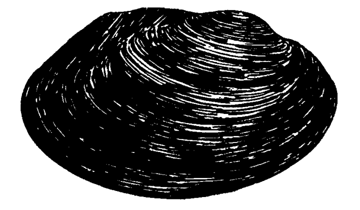
**Local:** Upper Egypt from Sohag to Beni Suef in the main River Nile.

**Status:** Common.

## 12. *Caelatura (Horusia) anergus* (Bourguignat, 1883)

**(Plate 11)**





**L = 47.5 mm**

### Synonym

*Unio (Horusia) anergus* Bourguignat, 1883.

### Description

The shell is medium-sized long ovoid, subelliptical and swollen posterio-ventrally. It is thicker anteriorly and thinner posteriorly, strong and subinflated. It is alate subtruncated posteriorly and rounded anteriorly with a curved ventral margin. The dorsal margin is nearly parallel, and the posterior end is broader than the anterior one, so the height is placed posteriorly.

The umbo is rather a big swollen knob, prominent and anteriorly placed. It distinctly protrudes over the anterior dorsal margin of each valve. The ligament is an elastic brownish cord.

The sculpture includes distinct concentric growth lines, and oblique ridges on the area and areola and sometimes on the area only. The beak sculpture consists of numerous bars each with a shallow central sinuation. They are parallel to the growth lines.

The hinge plate is denticulate of the heterodont type. It includes cardinal teeth and lateral teeth. The cardinal teeth include two teeth in the left valve. The first anterior one is elevated, pointed forward triangular in shape, and the second is straight depressed with an impression between them. In the right valve, there are two parallel teeth, the upper one is slightly elevated straight and longer than the lower one. The latter is highly elevated, sloped towards the anterior margin with a deep depression between them.

The lateral teeth include two well developed teeth in the left valve, parallel posteriorly and narrowed anteriorly. The lower one is more extended and elevated than the upper one. They are articulating with a straight well developed tooth in the right valve, which is more elevated posteriorly than anteriorly.

**Colour:** The colour of the outer shell (periostracum) varies from greenish to brownish. Narrow rays occur all over the shell in the young specimens but they may appear in old specimens on the disc area. Interiorly, each valve is smooth with blue iridescent nacre except the border and the beak cavity with rosey iridescence.

**Size:** The average size is 47.5(L), 27.5(H), 19.5(W) mm and the ligament length = 15 mm.

### Habitat

Slowly running and stagnant water, with muddy-sandy bottom.

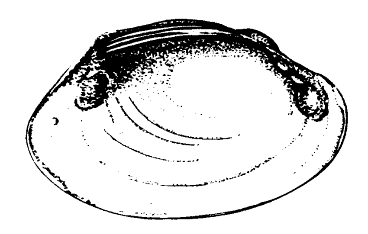
### Distribution

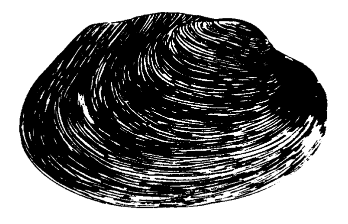
**Local:** Lower Egypt, Rosetta and Damietta branches of the River Nile

**Status:** Rare.

## 13. *Caelatura (Horusia) bourguignati* (Rochebrune, 1886)

**(Plate 12)**





**L = 49.5 mm**

### Synonyms

*Unio (Horusia) bourguignati* Rochebrune, 1886,

*Zairia disciformis* Rochebrune, 1886,

*Pharaonia bourguignati* Rochebrune, 1886,

*Unio stagnorum* Daautzenberg, 1890,

*Caelatura bomae* Pilsbry and Bequaert, 1927,

*Caelatura rotula* Pilsbry and Bequaert, 1927.

### Description

The shell is medium to large, thin to rather thick ovate, subtruncate posteriorly and alate. The posterior dorsal margin is straight, more prominent than the anterior short one and also parallel with the highly curved posterior margin. It is subinflated and compressed dorso-ventrally. The posterior end is highly broadened than the anterior round one, so that the height is placed posteriorly with a rounded posterior ridge.

The umbo is rather a big swollen knob, prominent and more anteriorly placed. It is slightly protruding over the posterior dorsal margin and is more protruding over the anterior dorsal margin. The hinge is an elastic brownish cord. The sculpture includes regular concentric growth lines and characteristic parallel striations (three pairs) on the disc area which are oblique dorsoventrally. The beak sculpture includes numerous bars or nodules, which are parallel with the growth lines. The insertions of the anterior adductors are deeper than the posterior ones.

There are some irregular nodules in the beak cavity of each valve, but not significant for the species.

The hinge plate is denticulate of the heterodont type. It contains cardinal and lateral teeth. The cardinal teeth include two well developed anchored teeth, which are sloped toward the anterior margin. The first one is triangular in shape and the second is more elevated than the anterior one. It extends slightly towards the beak cavity of the left valve. In the right valve, there is an elevated tooth sloped dorsobasally, and parallel to the anterior dorsal margin and connected posteriorly with the interdental plate. As a consequence, the interdental projections of the left valve are articulating with the interdental depression of the right valve and the beak cavity.

Lateral teeth include 2 well developed teeth in the left valve. They are sloped posteriorly, and the upper one is slightly elevated, but the lower one is more elevated. In the right valve there is a highly elevated tooth, sloped and broadened posteriorly but narrowed anteriorly. As a consequence, the interdental projection of the right valve is articulating with the interdental depression of the left valve.

**Colour:** Periostracum colour is greenish to brownish, with lustrous umbo. The colour of the posterior slope is darker than the rest. Interiorly, each valve is smooth with blue or white lustrous nacre.

**Size:** The average size is 49.5(L), 32(H), 19.5(W) mm and the ligament length = 17 mm.

**Habitat**

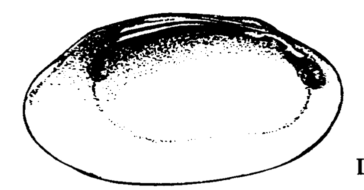
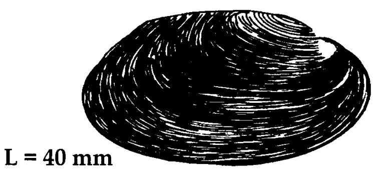
Slowly running and stagnant water, with sandy or sand-muddy bottom.

**Distribution**

**Local:** Lower Egypt; Rosseta and Damietta branches of the River Nile.

**Status:** Rare

## 14. *Caelatura* (*Horusia*) *petrettinii* (Bourguignat, 1883) (Plate 12)

L = 40 mm

**Synonym**

*Unio* (*Horusia*) *petrettinii* Bourguignat, 1883.

**Description**

The shell is subelliptical of medium strength and thickness. The dorsal and ventral margins are nearly parallel. The posterior dorsal margin is curved with a subtruncated posterior margin, and the anterior dorsal margin is sloped and has nearly a right angle with the anterior margin with slightly curved ventral margin. The shell is compressed dorsoventrally, subinflated and with a well marked posterior ridge. It is broader posteriorly than anteriorly, so that the height is placed posteriorly.

The umbo is a small swollen knob, which slightly protrudes over the dorsal margin. The hinge ligament is an elastic brownish cord. The sculpture includes regular concentric distinct growth lines, and some oblique ridges on the area and areola. The ridges of beak sculpture are distinctly double looped, forming two short radial rows of nodules on each valve. They are parallel to the growth lines.

The insertions of the anterior adductors are deeper than the posterior ones. The hinge plate is denticulate and of the heterodont type. It includes the cardinal and the lateral teeth. The cardinal teeth include two well developed narrow teeth in the left valve. The first anterior one is sloped dorsobasally but the second one is more broadened than the anterior one with a deep depression between them. The right valve carries one or two teeth, the upper one is a small projection like-tooth parallel with a highly elevated sloped one and with a deep depression between them.

The lateral teeth include two well developed parallel teeth in the left valve, sloped posteriorly. They are united anteriorly and the upper one is more elevated anteriorly, but the lower one is longer and more elevated posteriorly with a deep depression between them. In the right valve, there is an elevated tooth sloped posteriorly and narrowed anteriorly forming a protrusion-like tooth. Upper to that tooth, there is a

protrusion-like tooth and an insertion. As a consequence, the interdental projections are articulating with the interdental depressions in each valve.

**Colour:** Periostracum is greenish to brownish with greenish broadened bands. Interiorly, each valve is smooth with blue iridescence.

**Size:** The average size is 40(L), 21(H), 16.5(W) mm and the ligament length = 13 mm.

**Habitat**

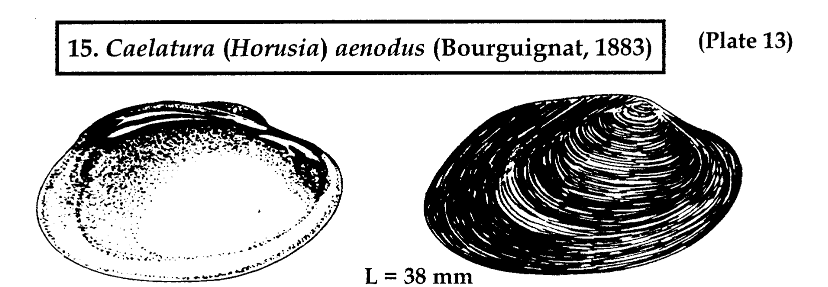
Slowly running and stagnant water.

**Distribution**

Lower Egypt: Rosetta and Damietta branches of the River Nile.

**Status:** Common.

## 15. *Caelatura (Horusia) aenodus* (Bourguignat, 1883) (Plate 13)




**Synonym**

*Unio aenodus* Bourguignat, 1883.

**Description**

The shell is elongate ovate, hard, subinflated compressed dorso-ventrally, and subtruncate to curved posteriorly, but rounded anteriorly. The dorsal and ventral margins are nearly parallel. The shell is broader posteriorly than anteriorly so that the height is placed posteriorly with a slightly winged posterior slope.

The umbo is a small swollen knob which is anteriorly placed and slightly protrudes over the dorsal margin. The hinge ligament is an elastic, tough strong and dark brownish cord.

The sculpture includes regular distinct growth lines with some oblique ridges on the area. In addition, the beak area includes zigzag sculptures, which are parallel to the lines of growth. The insertions of anterior adductors are deeper than the insertions of posterior ones.

The hinge plate is denticulate of heterodont type. It contains well developed cardinal and lateral teeth. The cardinal teeth include two narrowed well developed teeth. In the left valve, the anterior one is rather broad with striations on the upper surface, while the second posterior one is longer with a distinct curvature and with a deep depression between them. In the right valve, there are two parallel teeth, the upper one is weaker and the second is more elevated sloped anterio-ventrally. They are united posteriorly and in between them there is a deep depression.

Lateral teeth include two well developed slightly curved teeth. In the right valve, they are parallel, united anteriorly with a deep depression between them. In the right valve there is a single tooth slightly curved broader posteriorly and narrow anteriorly. As a consequence, the interdental projection of the right valve articulates with the interdental depression in the left valve.

**Colour:** Periostracum varies from olive green to brownish colour with dark green rays distributed over the entire shell. Interiorly, each valve is smooth with blue lustrous nacre all over the inner surface except the beak cavity; which is rosey lustrous.

**Size:** The average size is 38(L), 19(H), 15.1(W) mm.

**Habitat**

Slowly running water, with muddy sand and gravel bottom.

**Distribution**

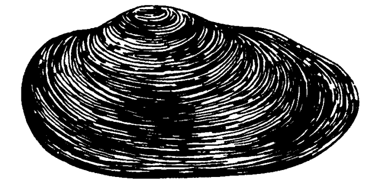
**Local:** Lower Egypt: Rosseta and Damietta branches of the River Nile.

**Status:** Rare.

### D. Subgenus: *Nitia*

**16. *Caelatura* (*Nitia*) *teretiuscula* (Philippi, 1847)**





**L = 51.5 mm**

**Synonyms**

*Unio teretiusculus* Philippi, 1847,

*Unio chariensis* Germain, 1906,

*Unio mutelaeformis* Germain, 1906,

*Nodularia (Lanceolaria) teretiusculus* Pallary, 1909,

*Unio (Nodularia) gaillardi* Germain, 1909,

*Nodularia teretiusculus* Simpson, 1914,

*Unio (Nitia) teretiusculus* Pallary, 1924.

**Description**

The shell is thick in young specimens to very thick and hard in old ones. It is distinguished by its comparatively greater length and lower altitude, together with the parallelism of the dorsal and ventral margins. The posterior dorsal margin ends in a sharp angle while the posterior end is pointed and the anterior one is regularly rounded and short. The shell is twice as long as high or longer, swollen dorsally and compressed dorsoventrally.

The umbo is rather a big swollen knob, slightly prominent and anteriorly placed. It protudes slightly over or with the dorsal margin. The hinge ligament is tough strong, dark brownish elastic cord found at the post umbonal area.

The sculpture includes distinct regular growth lines and the chevron- like sculpture is usually restricted to the beaks in young specimens. The insertions of the anterior adductors are deeper and more distinct than the posterior ones.

The hinge plate is denticulate and of the heterodont type. It contains well developed cardinal and lateral teeth. The cardinal teeth include double elevated, compressed, serrated, triangular teeth in the left valve. The first one is slightly elevated than the second one which slopes downward, with a big depression between them. A single stronger highly elevated tooth is sloped downward in the right valve while an upper additional tooth or a small projection-like tooth is present to complement the articulation. Lateral teeth include an erect, elongate, nearly straight, single tooth in the right valve, which is broadened posteriorly, but narrowed anteriorly. In the left valve, there are double parallel teeth broader posteriorly, but are narrow closed anteriorly.

**Colour:** The colour varies from greyish to dark brownish with a lustrous beak, especially in old specimens. Interiorly, each valve is smooth with orange and blue iridescence.

**Size:** The average size is 51.5(L), 23(H), 20(W) mm and the ligament length =18 mm.

### Habitat

It occurs in all kinds of water bodies, slowly, swift running, and stagnant waters, with sandy, muddy and sand-muddy bottom.

### Distribution

**Local:** Along the River Nile and its main canals from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

**World:** White Nile as far south as Lake Albert. Also in Lake Chad and the River Chari (Lévèque, 1967), and possibly in the Senegal River. It is possible that the shell belongs to a South American species and accidentlly got mixed with African material (Mandahl-Barth, 1982).

**Status:** Common.

### Remarks

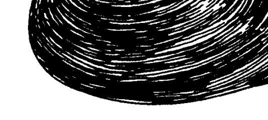
Stunted or dwarfed and reniform (bend) shells often occur and are the result of environmental conditions during growth e.g. high salinities and temperatures or substrate composition.

## Genus *Unio* Philipson, 1788

Shell is oval or oblong. Cardinal anterior teeth are rather thin and not forming a distinct angle to the hinge plate. Lateral teeth are normally developed. Umbonal sculpture, if present consists of a few rows of tuberculi or concentric folds. All the species of this genus which were used to live in the River Nile in Egypt, have become extinct. (Van Damme, 1988).

### 17. *Unio elongatulus dembeae* (Sowerby, 1825)





**L = 66 mm**

**Synonyms**

*Unio aeneus* Jickeli, 1874,

*Unio dembeae* Germain, 1909,

*Unio erlangeri* Kobelt, 1909.

**Description**

Shell is elongated and relatively large (66 x 33 mm, but usually smaller). The posterior and anterior dorsal margins are straight and parallel with an evenly and slightly curved ventral margin. The umbo is slightly protruding above.

**Habitat**

Stagnant or slowly running waters.

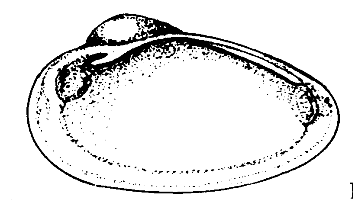
**Distribution**

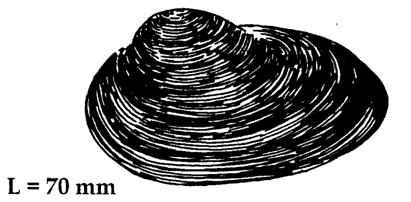
**Local:** Extinct. It was recorded from Fayoum area and Ballas (Germain, 1909).

**World:** Ethiopia in Lake Tana, in Omo River and in Somaliland.

**Status:** Extinct from Egypt.

## 18. *Unio abyssinicus* Martens, 1866





L = 70 mm

**Synonyms**

*Unio schweinfurthi* Martens, 1886,

*Unio willcocksi* Newton,1899,

*Unio vignardi* Pallary, 1924.

**Description**

An elongated, very thick and large unionid clam (70 x 43 x 32 mm) Dorsal posterior margin of the shell is downward-sloping and meeting the ventral margin in a blunt rostrum that is situated in the lower third of the height. Anterior dorsal margin is short and rather sharply downward-

sloping. The beak is prominent, large and inflated. As a rule, sculpture is absent in adult shells except for some indistinct ridges on the area.

**Habitat**

Stagnant or slowly running waters.

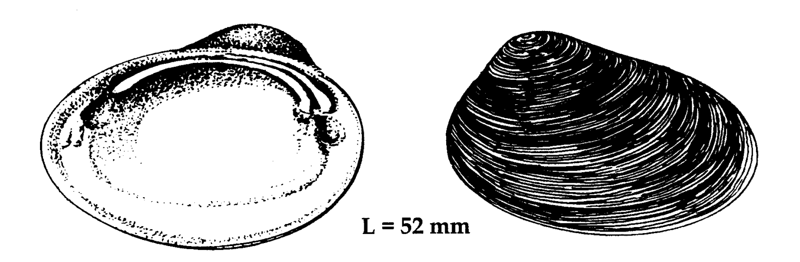
**Distribution**

**Local:** Extinct. Van Damme (1988) mentioned that it was recorded from the Upper Nile: Fayoum, Kom Ombo, Idfu and Isna.

**World:** Ethiopia in Lake Tana and the Blue Nile (Haas, 1969)

**Status:** Extinct from Egypt.

## 19. *Unio fayumensis* Pilsbry and Bequaert, 1927




**Synonyms**

*Unio dembeae* Rossm, 1883,

*Unio schweinfurthi* Martens, 1886.

**Description**

Shell is triangularly ovate, fairly convex, solid, concentrically striatulate and marked with more distinct lines of growth. Anterior margin is rounded, dorsal and ventral margins almost equally curved, dorsal margin is descending gradually from the umbo to the end of the lateral teeth, and thence obliquely subtruncate. Ventral margin is hardly ascending behind.

The posterior area is not very wide. Cardinal teeth are thick, in the right valve nearly single, but in the left are two, almost equal. Posterioly, lateral teeth are slightly curved, equal in length to half that of the shell.

**Habitat**

Stagnant or slowly running waters.

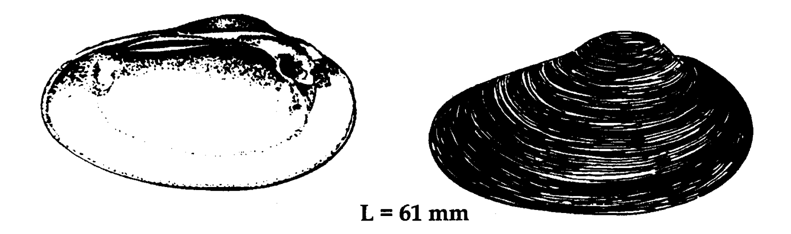
**Distribution**

**Local:** Extinct. It has been found in some freshwater localities in Lake Qarun, at the entrance of El-Bats drain (Gardner, 1932).

**World:** It was confined to Fayoum area, but some specimens were found in Morocoo (Gardner, 1932).

**Status:** Extinct from Egypt.

## 20. *Unio willcocksi* Newton, 1899




**Synonyms**

*Unio lithophagus* Wood, 1864,

*Unio willcocksi* (= *lithophagus)* Newton, *1899,*

*Unio schweinfurthi* Martens, 1901,

*Unio vignardi* Pallary, 1924.

**Description**

An elongated, thick and large unionid. Dorsal posterior margin is downward sloping. Anterior dorsal margin is short and rather sharply downward sloping. The beak is not prominent.

**Habitat**

Slow or swift running waters with muddy beds.

**Distribution**

**Local:** It used to occur in the River Nile tributaries at Kom Ombo, Idfu and Gebel Silsile (Gardner, 1932).

**Status:** Extinct from Egypt.

# FAMILY: MUTELIDAE

The shell is of medium to large size, and has sculpture only on the beaks. The hing-plate has no teeth, but in some species, it has a row of tubercles. Mutelidae species are found in South America, Africa and Australia. Mandahl Barth (1983) distinguished 3 genera in Africa: *Aspatharia, Spathopsis* and *Mutela* considering the genus *Pleiodon* as synonymous with *Mutela* or as a subgenus of it. On the other hand, Van Damme (1988) considered the genus *Pleiodon* as dstinctive in view of palaeontological evidence. As in Unionidae, the larvae of Mutelidae are parasitic on fishes but they are different from glochidia (Fryer, 1961). Only two genera occure in Egypt; *Mutela* and *Spathopsis.*

**Key to the genera**

1- Shell is without a particular umbonal sculpture; mantle edges are fused along presiphonal suture .................................................................. ***Mutela***

2- Umbonal sculpture consists of parallel, broadly V-shaped ridges, presiphonal suture is short or absent...................................... ***Spathopsis***

## Genus *Mutela* Scopoli, 1777

The shell is usually rather long and narrow, but in some species higher and, more or less, winged. The hinge-plate does not terminate posteriorly in a triangular sinulus. The presiphonal suture is long.

It is an afrotropical genus, with about 75 species, mainly described by French malacologists and now reduced by Mandal-Barth (1983) to only 10 species. In Egypt, only 3 species were recorded.

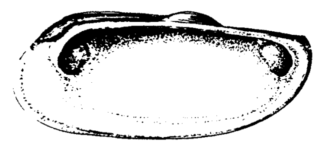
**Key to the species**

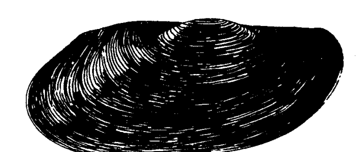
1- Full grown shell is thick and heavy, with a length of about 165 mm. The posterior margin is broad and truncate the shell obliquely.... ... ***Mutela dubia nilotica***

2- Full grown shell is thick and about 170 mm long. Dorsal and ventral margins are almost parallel, and narrowed at the anterior end, without an angle or wing to the dorsal margin............................. ***Mutela rostrata***

3- Full grown shell is about 90 mm long, thin, fragile, and with anchored anterior end...................................................................... ***Mutela singularis***

### 21. *Mutela dubia nilotica* (Cailliaud, 1823) **(Plate 14)**





**L = 134 mm**

**Synonyms**

*Mytilus dubius* Gmelin, 1790,

*Iridina nilotica* Cailliaud, 1823,

*Spatha (Mutela) plicata* Martens, 1866,

*Mutela nilotica* Blanckenhorn, 1901,

*Mutela angustata* var. *curta* Germain, 1905,

*Mutela dubia* Simpson, 1914,

*Mutela singularis* Pallary, 1924,

*Mutela angustata* Arkell, 1949.

**Description**

A very large elongate-ovate shell, with an almost straight dorsal margin rising posteriorly so that the largest height is situated posteriorly to the beaks, with a corresponding anterior narrowing. As a consequence, the posterior margin is broad and truncate the shell obliquely.

The shell is thin in juveniles till 85 mm long, and very thick in old individuals from 100-165 mm long. Ventral margin is weakly curved but more round and downward sloping at the anterior side. Rostrum is in the lower third of the total height. The rostrum or umbo is a small swollen knob, found anterio-dorsally, and slightly protrudes over the dorsal margin.

The hinge ligament is a dark brown elastic cord found at the dorsal edge. The posterior slope is compressed and somewhat alate in young specimens. The sculpture includes regular growth lines with vertical faint rays from the umbo to the rest of the shell, which are more distinct in juveniles. The posterior adductor insertions are deeper than the anterior ones. The hinge plate is smooth (without hinge teeth) and nearly straight along the hinge line.

**Colour:** The colour of the outer shell (periostracum) is greenish to dark brownish. Interiorly, each valve is smooth and has a blue colour with red iridescence

**Size:** The size of the full grown shell is 165(L), 69(H), 49(W) mm and the length of the hinge ligament is 68mm. Usually the height is more than the length of the ligament. The average size is 134 x 85 x 35 mm and the HL (hinge length) = 47mm.

**Habitat**

It is always associated with sandy, muddy or sand-muddy deposits.

**Distribution**

**Local:** Along the River Nile: El Riahs and the main canals from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

**World:** West Africa from Senegal to Chad, Southwards to the Congo River and in Eastern Africa throughout the Nile Basin.

**States:** Common

**Remarks**

It withstands pollution to some extent.

**22.** ***Mutela rostrata*** **(Rang, 1835)** **(Plate 14)**




**L= 145mm**

**Synonyms**

*Iridina rostrata* Rang,1835,
*Iridina caelestis* Lea, 1838,
*Mutelina legumen* Rochebrune, 1886,
*Mutelina prasina* Rochebrune, 1886,
*Mutelina mabilli* Rochebrune, 1886,
*Mutelina pauldicola* Rochebrune, 1886,
*Mutelina joubini* Germain, 1904,
*Mutelina falemeensis* Germain, 1907,
*Mutelina aegyptiaca* Pallary, 1924,
*Mutela langi* Pilsbry and Bequaert, 1927,
*Mutela iris* Pilsbry and Bequaert, 1927,
*Mutela carrei* Schwetz and Dartevelle, 1948.

**Description**

It has an elongated shell, thin in juveniles (L = 85 mm), very thick in old ones (L = 120-170 mm), with almost parallel dorsal and ventral margins or a faintly curved ventral margin and usually greenish to brownish on exterior side.

It has an evenly rounded narrow anterior end without an angle to the dorsal margin. The pronounced rostrum is situated at the mid-height devoid of the posterior dorsal wing. The umbo is a small swollen knob, found anterio-dorsally and represents the apex. It is situated at the first third of the shell. At the end of the hinge ligament there is a very marked posterior tapering with a visible notch, nearly $^{2}/_{5}$ the length of the shell.

The sculpture includes distinct regular growth lines which are more apparent posteriorly than anteriorly, with vertical faint rays from the umbo to the rest of the shell. The posterior adductor insertions are more distinct than those of the anterior ones. The hinge plate is smooth (without hinge teeth) and straight nearly along the hinge line.

**Colour:** The colour of the outer shell (periostracum) is greenish, brownish or with alternating greenish and brownish bands. Interiorly, each valve is smooth and has a blue colour with a red iridescence.

**Size:** The size of the full grown shell is 170(L), 70(H), 40(W) mm and the length of the ligament is 71 mm, which is almost more than the height.

**Habitat**

It is always associated with sandy, muddy or sand-muddy deposits. Also it is usually associated with *Mutela dubia nilotica.*

**Distribution**

**Local:** Along the River Nile and its main canals from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

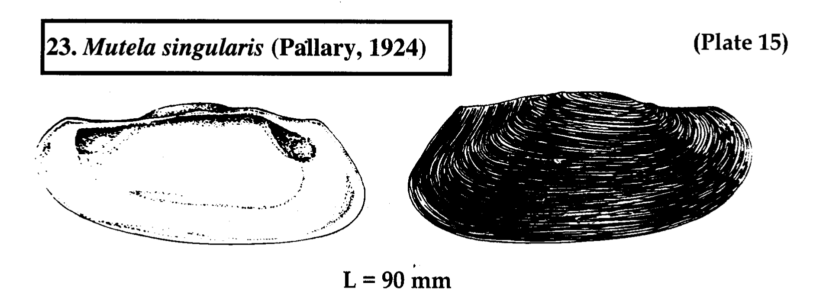
**World:** West Africa in Senegal River, Niger River, Lake Chad and its tributaries into Central Africa and Khartoum. In Lake Albert and Lake Edward (Mandahl-Barth, 1954).

**States:** Common

**Remarks**

It can withstand pollution to some extent.

**23. *Mutela singularis* (Pallary, 1924)** **(Plate 15)**



**L = 90 mm**

**Synonyms**

*Mutelina singularis* Pallary, 1924,

*Mutela nilotica* Mandahl Barth, 1988.

**Description**

It has a relatively elongate-ovate shell, with an irregular dorsal margin. The dorsal margin is relatively broadening, so that the largest height is situated posterior to the beaks. As a consequence, the posterior margin is broad and truncate the shell obliquely. The anterior side is angular, prow-like with a circular anterior margin.

The shell is very thin to fragile. It is compressed dorsoventrally in the middle. The rostrum or umbo is a big swollen knob found nearly in the middle. It is visible, protruding over the dorsal margin and represents the apex. The ligament is sloping dorso-posteriorly.

The sculpture includes regular distinct wavy growth lines with vertical faint rays from the umbo to the shell. The posterior adductor insertions are highly deeper than the anterior ones and triangular in shape. The hinge plate is smooth (without hinge teeth) and irregular along the hinge line.

**Colour:** The colour of the outer shell (periostracum) is dark greenish to yellowish-green. Interiorly, each valve is smooth and has a white or a blue colour with red iridescence.

**Size:** The size of the biggest shell is 90(L), 38(H), 29(W) mm and the ligament length = 25 mm.

**Habitat**

Associated with sandy or sand-muddy deposits.

**Distribution**

**Local:** Lower Nile and its main canals to El-Giza region. Pallary (1924) collected it from El - Mahmoudieh Canal.

**Status:** Rare.

### Genus: *Spathopsis* Simpson, 1900

Pilsbry and Bequaert (1927) regarded *Spathopsis* as a subgenus of ***Spatharia***, but Daget (1961) gave it a generic rank. The two important characters are the umbonal sculpture consisting of concentric ridges and the presence of a short presiphonal suture, but they are difficult to observe on empty shells. However, full-grown shells of most *Spathopsis* species have a relatively higher shell than most *Aspatharia* and they attain a larger size, in most cases exceeding 100 mm in length. They differ from the large-sized *Mutela* by the umbonal sculpture. The hinge plate is stronger and terminating posteriorly in a more distinct sinulus and

usually with a dilation on the left valve fitting under the hinge plate of the right valve.

Six or seven species belong to this exclusively Afrotropical taxon are widely distributed from Senegal to Egypt to Transvaal and mainly occurring in lacustrine environments, but they can also live in running water. Three species were recorded in Egypt, one is still existing and the other two are extinct.

**Key to species and subspecies**

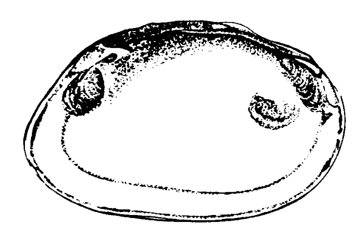
1- Shell is ovate - elongate and not heavy. Hinge plate is narrow and more elongate. Posterior part of hinge plate with a L / H ratio of 5.0, and L / H ratio of the shell = 1.6 .................................. ***Spathopsis rubens arcuata***

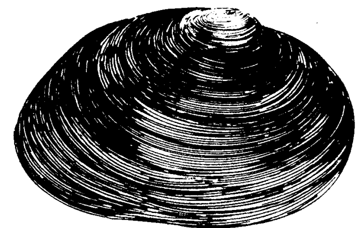
2- Shell is elongate and L / H ratio is between 1.8 - 2.0. Ventral margin is strongly concave, dorsal posterior margin is downward sloping ................................................................***Spathopsis wahlbergi letourneuxi***

3- The shell is relatively low. Ventral margin and posterior dorsal margin are straight. L / H ratio = 2.0..............***Spathopsis wahlbergi hartmanni***

## 24. *Spathopsis rubens arcuata* (Cailliaud, 1823)

**(Plate 15)**





**L = 159 mm**

**Synonyms**

*Anodonta arcuata* Cailliaud, 1823,

*Anodonta rubens* Cailliaud, 1823,

*Anodonta anataria* Cristofori and Jan, 1832,

*Spatha caillaudi* Martens, 1866, (misspelling of *cailliaudi*),

*Spatha lepsii* Jickeli, 1874,

*Spatha innesi* Pallary, 1903,

*Spatha rubens* var. *cailliaudi* Germain, 1909,

*Anodonta cailliaudi* Sandford, 1936,

*Aspatharia (Spathopsis) cailliaudi* Mandahl-Barth, 1954.

**Description**

The shell is large ovoid in shape, with a curvature of the dorsal margin, more gradually down curving anterior margin and the posterior margin is broad. The shell is compressed dorsoventrally and the largest height is situated at the mid-dorsal point.

The shell is thin in juveniles till 95 mm length, and very thick in old individuals from 120 to 180 mm or larger. Ventral margin is highly curved in small specimens, but slightly curved in larger ones. The umbo is a small swollen knob which is found antero-dorsally, slightly protruding over the dorsal margin and represents the apex.

Characteristic for the species is that the right valve is slightly protruding over the left one, from the umbo to the anterior end, so that the height of the anterior right valve is more than the left one with 2-3 mm, and the length of the right valve exceeds with 1 mm than the left one. The hinge ligament is a tough, dark brown elastic cord, found at the post umbonal area by which the two valves of the shell are united and hinged with one another. The former is extraordinarily heavy, weighing over 340 g.

The sculpture includes heavy concentric regular growth lines traversed by greenish rays from the umbo to the rest of the shell, the rays appear in young specimens only. The anterior and posterior retractors and the protractor have deep insertions.

The hinge plate is very strong without hinge teeth terminating posteriorly in a more distinct sinulus, and usually with a dilation on the left valve fitting under the hinge plate of the right valve. Above this part of the hinge plate, the dorsal margins of the two valves don't meet except at the umbo area and form a rather long tapering groove in both ends which is normally widest on the left valve.

**Colour:** The colour of the outer shell (periostracum) is light greenish to dark-brownish. Interiorly, each valve is smooth, lustrous, blue-whitish or white-bluish with red iridescence.

**Size:** The average size in the Nile is 159 (L), 105 (H), 54 (W) mm, but the biggest ones are about 180 x 115 x 63 mm.

## Habitat

All types of water bodies, swiftly and slowly running or stagnant waters. The large specimens are collected from ponds, but the specimens from the Nile are smaller than those of the ponds.

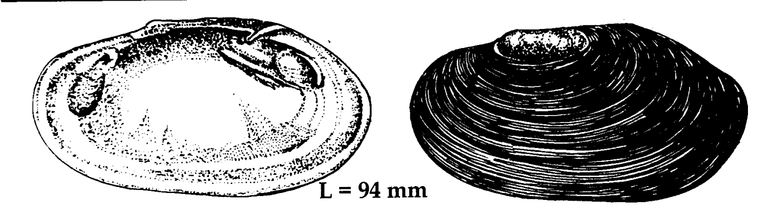
## Distribution

**Local:** Main Nile and its main canals and ponds from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

**World:** Northern Sudan (the Nile).

**Status:** Common.

## 25. *Spathopsis wahlbergi hartmanni* (Martens, 1866) .




## Synonyms

*Spatha hartmanni* Martens, 1866,

*Spatha marnoi* Jickeli, 1894,

*Spathella fourtaui* Pallary, 1903,

*Spathella bozasi* Rochebrune & Germain, 1904,

*Spathella brumpti* Rochebrune & Germain, 1904,

*Spatha wahlbergi* Simpson, 1914.

*Aspatharia wahlbergi hartmanni* Pilsbry and Bequaert, 1927,

*Aspatharia hartmanni* Gardner, 1932.

## Descripition

Shell is elongate 94 (L), 45.5 (H), 2.7(W) mm, with straight dorsal posterior and ventral margins and evenly curved, large anterior side. Rostrum is at mid-height, beak is low and level with the dorsal margin. Exterior colour is light brown to greyish- brown; interior is pinkish.

## Habitat

In slow- running waters and muddy areas.

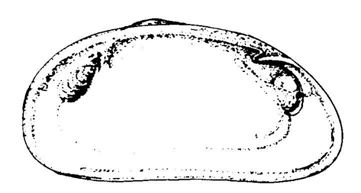
**Distribution**

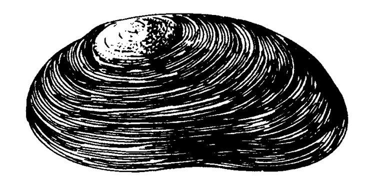
**Local:** Extinct [It was recorded from Fayoum area and Upper Nile (Gardner, 1932)].

**World:** Kenya, Sudan, Ethiopia and South Africa.

**Status:** Extinct from Egypt.

## 26. *Spathopsis wahlbergi letourneuxi* (Bourguignat, 1890)





**L = 78 mm**

**Synonyms**

*Chambardia letourneuxi* Bourguignat, 1890,

*Chambardia rhychoidea* Bourguignat, 1890,

*Chambardia locardiana* Bourguignat, 1890,

*Chambardia locardi* Bourguignat, 1890,

*Chambardia bourguignati* Letourneux, 1890,

*Chambardia pharaonum* Bourguignat, 1890.

**Descripition**

Juvenile shells closely resemble those of *Spathopis wahlbergi hartmanni;* adult shells are elongated, elliptic (79(L), 41(H), 25(W) mm and distinctly inequilateral. The right valve is thinner, smaller and more flattened than the left one. Beaks are projecting and smooth. Dorsal margin is strongly curved, ventral margin is concave. Hinge plate is heavy with distinct lamellar teeth ridges. Exterior colour is dark brown; interior is reddish purple.

**Habitat**

Stagnant water at the bottom of deep water.

**Distribution**

**Local:** It was recorded in the Nile Delta and Fayoum area (Gardner, 1932; Van Damme, 1988).

**Status:** Extinct from Egypt.

## FAMILY: ETHERIIDAE

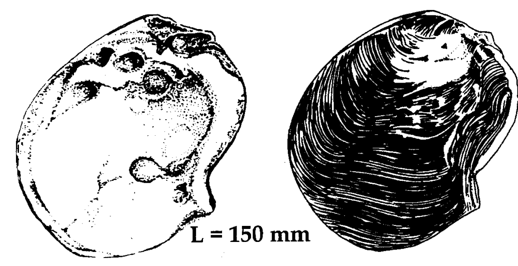
A small family of sessile, oyster-like bivalves, with irregular shells. It comprises three genera, one in India, one in South America and *Etheria* in Africa. Earlier, Mandahl-Barth (1988) included *Etheria* (and the other two genera) in the Mutelidae, but later he accepted the distinct family, already proposed by Swainson (1840).

### Genus *Etheria* Lamarck 1807.

About twenty supposed species have been described, but now it is agreed that all forms belong to a single species, for which the oldest name is *Etheria elliptica* Lamarck being the first of four species described by Lamarck (1807). Oken in 1818 (Mandahl-Barth, 1988) correctly altered the name to *Aetheria* which was used by most authors until 1927, when Pilsbry and Bequaert resuscitated the original spelling. Frussac (1823) was the first to state the African origin of *Etheria*, when he described *Etheria cailliaudi* from the Blue Nile. It differs from all other African freshwater bivalves by the irregular shell, usually with one of the valves cemented to a rock, another shell or other firm substratum, and taking shape from it. The life cycle is unknown. Possibly, in view of the small size of its eggs, *Etheria* has free swimming larvae (Mandahl-Barth, 1988).

### 27. *Etheria elliptica* Lamarck, 1807

**(Plate 16)**




**Synonym**

*Aetheria elliptica* Pallary, 1909.

**Description**

It has an irregular shell, taking the shape from the firm substratum. As a consequence, it may be ovoid, elliptical, or other shapes. The shell varies from thin to rather thick, solid and sharp. The lower valve, sometimes the left and sometimes the right, often has a lamellous structure and, as a rule, thicker than the upper valve.

The beak and the hinge plate of the upper valve protrude over those of the lower one. The shape of the shell varies from almost hemispherical to very elongate and in some cases the upper valve is provided with long, hollow tube-like projections. The umbo differs from other bivalves by its inequality of the umbo part on the left and right valves, but each part with the rest of each valve fitted one another.

The sculpture includes concentric wavy regular growth lines with faint ones in between and distinct lateral right ridges. Insertions of muscles include two adductors, one towards each end of the shell.

The valves are hinged together by a band of soft horny material which, but for the pulling action of the adductor, would cause them to gape apart. To greater stability and security of closing the valves, there is just below the horny hinge a more or less, intricate series of ridges and depressions in the solid material of one valve which fit with wonderful accuracy into corresponding ridges and depressions on the other valve.

**Colour:** The colour of the outer right valve is always olive green, but the lower left one matches the colour of the substratum. Interiorly, each valve is smooth, lustrous with white iridescence.

**Habitat**

It occurs in fast running waters, like rapids, cataracts and even waterfalls. It is, however, always associated with a rocky bottom, and sometimes with other firm substratum which it takes its shape.

**Distribution**

**Local:** In Upper Egypt, and at El-Ibrahimia Canal. But it was recorded from Toukh, Fayoum, Aswan, Karnak, Ballas and Kom Ombo (Leigh and Butzer, 1968).

**World:** Rivers and lakes of Madagascar and tropical Africa with a northern limit of its range the Senegal and Niger Rivers (Bourguignat, 1881), Lake Chad (Germain, 1907), Lake Tana (Bacci, 1951).

**Status:** Very rare.

**Remarks**

*Etheria* may aggregate in the rivers and can form impressive reefs of several meters height. In the Upper Nile, they sometimes can impede navigation.

# B- SUPERFAMILY: SPHAERIACEA

The Sphaeriacea are subovate or subtriangular with porcellanous shells and lateral hinge teeth both anterior and posterior to the cardinal teeth. They are generally small in size, found in fresh and in brackish water and are world-wide. The young are held in the mantle cavity during juvenile growth and, in contrast to Unionidae, no parasitic stage occurs. Two freshwater families are recognized in Egypt, Corbiculidae, and Sphaeriidae.

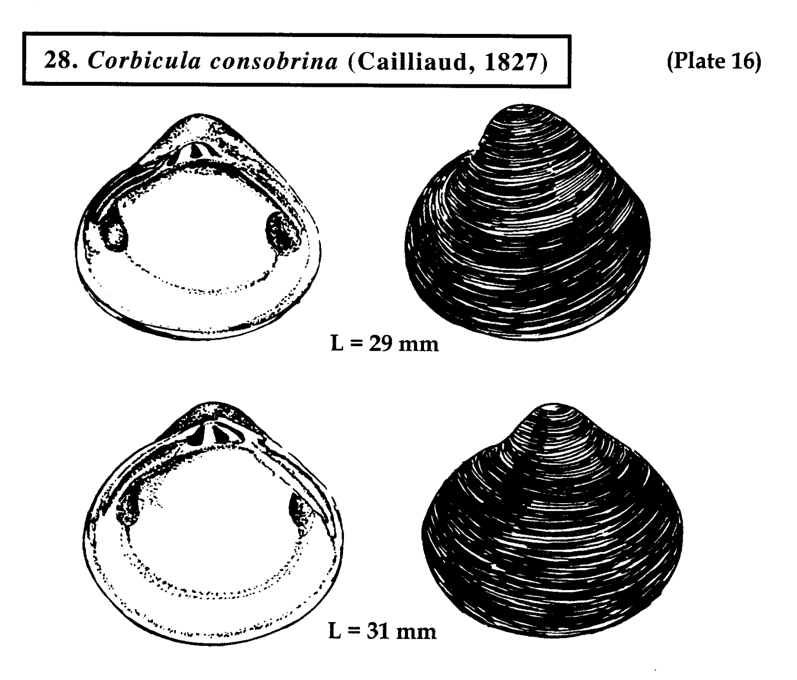
## FAMILY: CORBICULIDAE

The shell is oval or trigonal, rather solid and often with a concentric sculpture. The hinge-plate bears 2 or usually 3 diverging cardinal teeth in each valve, and in the left valve one and in the right valve two long anterior and posterior lateral teeth. The ligament is external. In Africa there is only one genus.

### Genus *Corbicula* Mühlfeld, 1811

The shell is rather small or medium-sized, with long and crenulate lateral teeth. The inner gills serve as marsupium for the numerous small eggs.

**28. *Corbicula consobrina* (Cailliaud, 1827)** **(Plate 16)**



**Synonyms**

*Corbicula fluminalis* Müller, 1774,

*Cyrena consobrina* Cailliaud, 1827,

*Corbicula africana* Krauss, 1848,

*Corbicula zelebori* Jickeli, 1874,

*Cyrena radiata* Smith, 1877,

*Corbicula saharica* Fischer, 1878,

*Corbicula nilotica* Clessin, 1879,

*Corbicula natalensis* Clessin, 1879,

*Corbicula alba* Clessin, 1879,

*Corbicula artini* Pallary, 1902,

*Corbicula lacoini* Germain, 1905,

*Corbicula aegyptiaca* Germain, 1906,

*Corbicula subtruncata* Germain, 1906,

*Corbicula innesi* Bourguignat : Sandford and Arkell, 1929.

**Description**

The shell varies in thickness from fragile in young specimens to semi-solid and solid in adult specimens. The other form or species (*Corbicula fluminalis*) is rounded triangular, and with a strong concentric sculpture.

*Corbicula consobrina* has two dorsolateral globose areas which flatten towards the ventral margin. The umbo is prominent and projecting slightly above the point of contact of the dorsal margins of the shell. It is conical in shape, having nearly a median position on the two valves. The latter are united together by the ligament which is rather small, yellowish or light brownish in colour. It is of an opisthodetic type because it is seated behind the cardinal teeth. The length is almost less than 6 mm.

Interiorly, each valve is smooth and varies from purple bluish to whitish in colour, and in some shells being dark blue between the pallial line and the basal margin. The muscle insertions appear as roughened areas on the smooth inner surface. They include the anterior and the posterior adductors and the anterior and the posterior retractors.

The pallial line is continuous, distinct, circular, extending between the ventral limits of the adductors and retractors, the anterior and the posterior. It runs parallel with the ventral margin.

The hinge plate is denticulate, of a heterodont type with three elevated cardinal teeth and two lateral ones in each valve. The cardinal

teeth of the left valve are corresponding to the second, third and fourth cardinal teeth of the right valve, while the lateral teeth include two anterior and two posterior lateral teeth in the right valve.

The two anterior-lateral teeth are found one above the other, near and parallel to the dorsal margin of the anterior part of the shell valve. They extend close to the first cardinal tooth, to a point just anterior to the anterio-dorsal limit of the anterior adductor muscle insertion, and in between them lies an elongate narrow groove.

The two posterio-lateral teeth extend backwards till a point just posterior to the adductor muscle insertion. They are united anteriorly into a single short smooth tapering protrusion. The lateral teeth of the left valve, and the lower anterior and posterio-lateral teeth of the right valve are transversely serrated. As a consequence, the interdental projections of each valve are articulating with the interdental depressions of each one

**Colour:** Periostracum is variable in colour from greenish, greenish yellow in young specimens to olive green and dark brownish in adult specimens. The juveniles are characterized by three flashes of colour greenish or purple colour centrally, and yellowish on both sides, in addition to heavy concentric lines of growth consisting of alternating dark and light bands.

**Size:** The basic form (*Corbicula consobrina*) is more regularly oval and longer than high (27 (L), 24 (H), 17 (W) mm), while *C. fluminalis* is slightly higher than long (26.4x 28.6 x 16 mm).

**Habitat**

All kinds of water bodies, slowly and swift running and stagnant water. They are found burried in clay at the bottom and on the shores. They are associated with all kinds of substrata, sandy, sand-muddy, and muddy substrata.

**Distribution**

**Local:** Along the River Nile and its tributaries from Upper Egypt to Rosetta and Damietta branches (Lower Egypt).

**World:** Lake Tana and the Blue Nile near Khartoum (Mandahl-Barth, 1954), Senegal and Algeria.

**Status:** Common.

**Remarks**

Many authors consider *Corbicula consobrina* to be a subspecies or race of the Asiatic *C. fluminalis* Müller, because some populations of *Corbicula consobrina* from the Lower Nile and Lake Tana are morphologically inseparable from *C.fluminalis* (Van Damme, 1988).

However, most Sudanian populations differ from *C. fluminalis*. At the same time, they also differ among each other, which might indicate the existance of several strains, although intermediate forms have also been recorded. Van Damme (1988) suggested to consider *Corbicula fluminalis* as a superspecies and *C.consobrina* as representing this superspecies in the River Nile basin.

On the other hand, Mandahl-Barth (1988) after examining a large number of *Corbicula* species from many parts of Africa, he came to the conclusion that the many supposed species which have been described in the Nile basin can be gathered in one variable species, *Corbicula fluminalis*, and *C. consobrina* is only a form of it, though it has been described by Cailliaud (1823) as a separate species under the name *Cyrena consobrina*.

# FAMILY: SPHAERIIDAE

The shell is small to minute (less than 1 inch long), subovate, subrhomboid, or subtriangular. The ligament is short and delicate and the pallial line is simple and indistinct. Lateral teeth are moderately long, placed both anteriorly and posteriorly to the umbo, with both sets double in the right valve and single in the left. Cardinal teeth are small, located between the lateral sets in each valve, generally single in the right valve and double in the left one. Three genera of these small mussels occur in Africa: *Sphaerium, Pisidium* and *Eupera.*The representatives of this family are dioecious and hermaphroditic. Their capacity for rapid dispersal over large distances is fantastic (by clinging to extremities of water insects, fishes, amphibians and the feathers of birds). Restriction of their range is therefore usually not of geographical but more of climatological and chemical nature (Van Damme, 1988).

**Key to the genera**

1- Large forms, 5 to 25 mm long. The umbo is usually placed near the middle. No black spots on the exterior. Two cardinal teeth in the left valve............................................................................................ ***Sphaerium***

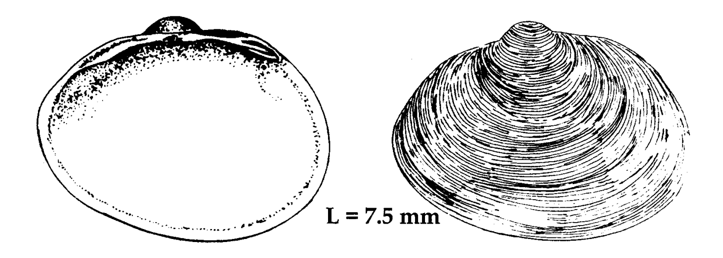
2- Smaller forms, usually 2-12 mm long. The umbo is usually placed behind the middle. Two cardinal teeth in the left valve.......... ***Pisidium***

3- The umbo is situated distinctly anterior to the middle. Black spots on the shell. Cardinal teeth are reduced to a single nodule.............. ***Eupera***

## Genus Sphaerium Scopoli, 1777

Shells are small (5mm) to medium-sized (25mm), subovate to subrhomboid, with the umbo located centrally or anterior of center. A distinct anal siphon and a distinct branchial siphon are present but they are fused either basally or for most of their length. Four gills are present, 2 in each side and the inner nephridial tube is looped in an anterio-basal direction. The majority of African species are quite variable and therefore difficult to define, and since many of them can be subdivided into geographical races, the question of species becomes difficult. The number of African species is low, but mostly are widespread. According to Mandahl-Barth (1988), all *Sphaerium* species described from Egypt and Sudan should be referred to only one species, *Sphaerium hartmanni* (Van Damme, 1988).

## 29. *Sphaerium (Musculium) hartmanni* (Jickeli, 1874) (Plate 13)




### Synonyms

*Cyclas hartmanni* Jickeli, 1874,

*Sphaerium pharaonum* Bourguignat, 1909,

*Sphaerium teilhardi* Pallary, 1909.

*Sphaerium* (*Corneola*) *teilhardi* Pallary, 1909,

*Cyclas* (*Sphaerium*) *teilhardi* Leiper and Thomson, 1916.

### Description

The shell is very thin to fragile, slightly inflated and compressed dorsoventrally. The dorsal anterior margin is higher than the posterior one and both are slightly curved, forming anteriorly a blunt angle with the anterior margin. Posteriorly, it is more evenly rounded and the ventral margin is well curved and slightly longer than the dorsal margin.

The umbo is a small swollen knob, slightly submedian and slightly protruding over the dorsal margin and represents the apex or the oldest part from which the growth of the valves has proceeded. The two valves are connected by a small fragile cord, the hinge ligament. It is placed at the post umbonal area (an opisthodetic type) by which the two valves of the shell are united and hinged with one another.

Interiorly, each valve is smooth with light transparent appearence. The insertions of muscles are smooth and include that of anterior and posterior adductors. They are connected by a rounded streak parallel to the free edge of each valve. This marks the insertions of muscle fibres which arise on the mantle edge, connecting it to the shell and is thus known as the pallial line which is simple and delicate.

The hinge plate is denticulate, of heterodont type, and contains small cardinal teeth and lateral teeth. Lateral teeth are moderately long placed both anteriorly and posteriorly to the umbo with both sets double

in the right valve and single in the left valve. In the left valve, there is a moderately long anterior lateral tooth, and a posterior lateral tooth, but in the right valve there are two anterior lateral teeth; with a depression in between. Also there are two posterior lateral teeth, holding between them a depression. Cardinal teeth are small, located between the lateral sets in each valve, generally single in the right valve and double unequal in the left one with a depression in between them. As a consequence, the interdental projections are articulating with the interdental depressions in each valve.

**Colour:** The sculpture consists of very fine striations and faint radial lines. The colour of the outer shell (periostracum) is usually light greyish with a lighter peripheral zone or light yellowish, sometimes glossy.

**Size:** The shell is rather small to medium size (average dimensions: 7.5 (L), 6.2 (H), 3.4 (W) mm and somewhat short in outline.

**Habitat**

All types of water bodies, running, slowly and swift running and stagnant water. It is the prevailing form of sandy, sandy-mud and muddy deposits. This species is important in the diet of many fishes.

**Distribution**

**Local:** Along the River Nile and its main canals from Upper Egypt to Rosettea and Damietta branches (Lower Egypt).

**World:** The Nile basin from Lower Egypt as far south as Bahr el Gebel in south Sudan (Preston, 1913) and the Ethiopian Highlands.

**Status:** Common.

## Genus *Pisidium* Pfeiffer, 1821

Shells are very small (2 mm) to medium-sized (12 mm), oval, globose or somewhat angular. The umbo is placed behind the middle of the shell and the ligament is slightly exposed or completely immersed. Only the anal siphon is developed and the branchial siphon being either rudimentary or represented by a mantle cleft.

**Key to species**

1- Shell length of adult in excess of 6 mm; strongly striated, hinge is heavy, second and third cardinal teeth are sharply bent ........................................................................................ ***Pisidium amnicum***

2- Length of adult shell is usually between 2 to 6 mm. Ligament and ligament pit are external and visible from outside .......***Pisidium pirothi***

3- Hinge plate is without callus. Umbo is posteriorly placed, therefore the posterior part of the shell is much shorter than the anterior one,

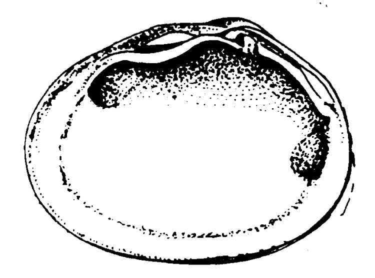
irregular striations. Hinge is curved and is relatively strong ..................
.................................................................................. ***Pisidium subtruncatum***

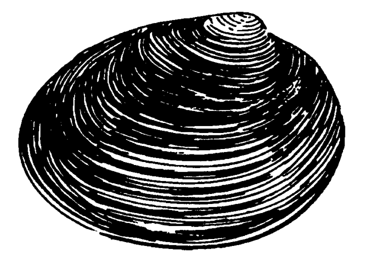
4- Umbo is almost median. Ligament pit is broad and short; shell is glossy; cardinal teeth are short.................................................. ***Pisidium nitidum***

5- Ligament pit is forming a long groove. Shell is dull and opaque. Umbo is submedian; hinge plate is strong and curved, cardinal teeth are large, curved and striations are irregular ............. ***Pisidium casertanum***

6- Striations are regular; shell is porous; hinge is very strong and arched; umbo is delineated by several faint grooves........... ***Pisidium kenianum***

## 30. *Pisidium amnicum* (Müller, 1774)





**L = 9.0 mm**

### Synonyms

*Tellina amnicum* Müller, 1774,

*Pisidium amnicum* var. *elongatum* Martens, 1866,

*Pisidium marteli* Pallary, 1909.

### Description

It is the largest species of the genus, where the average dimensions are 9 x 7 x 5 mm, but sometimes reaching a size of 14 mm. long. Shell is oval or obliquely triangular, solid, strongly striated. Umbo is prominent and posteriorly situated. Anterior part is elongated, posterior part is short and subtruncated. Hinge plate is strong and broad; ligament pit is very long and broad. There are two cardinal teeth in the left valve: the anterior one is strongly curved but less than the single cardinal tooth of the right valve, which is bifid posteriorly. The posterior cardinal tooth of the left valve is not very prominent. Anterior lateral tooth of the left valve and the anterior lateral teeth of the right one are very robust, while the posterior lateral teeth are less developed.

**Habitat**

Stagnant or slow running waters.

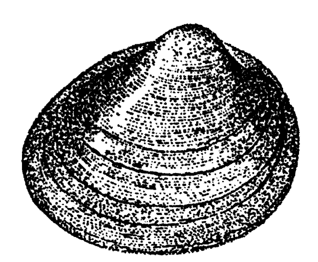
**Distribution**

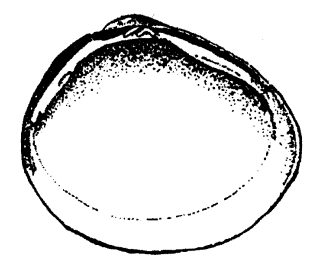
**Local:** It was recorded from some localities in the Nile, near Cairo (Mandahl-Barth, 1988).

**World:** The type locality is Frederiksdal, Denmark. N.W. Africa: Morocco and Algeria (Kuiper, 1972).

**Status:** Rare.

## 31. *Pisidium casertanum* (Poli, 1791)





**L = 5.2 mm**

**Synonyms**

*Cardium casertanum* Poli, 1791,

*Pisidium abditum* Haldeman, 1841,

*Pisidium (Fossarina) casertanum* Pallary, 1909,

*Pisidium ruwenzoriense* Germain, 1911.

**Description**

The shell is rounded, ovate to triangulate, small, inflated and regularly striated, dull to slightly glossy. Umbo is broad and relatively depressed. It is the largest of the small species, average dimensions are 5.2 x 4.0 x 2.8 mm. Hinge plate is curved, ligament pit is long and broad. Anterior cardinal tooth of the left valve is distinctly arched, single cardinal tooth of the right valve is prominent, arched, posteriorly bifid or grooved. Lateral teeth are strongly developed.

### Habitat

*Pisidium casertanum* has succeeded in adapting itself to a wide variety of habitats: in muddy ponds, lakes, rivers and even in swamps that dry up for several months of the year (Clarke, 1973).

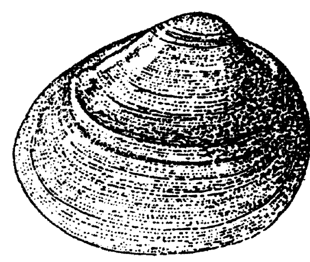
### Distribution

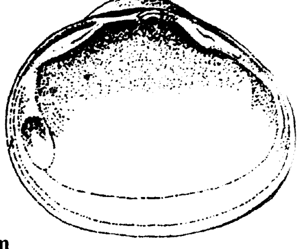
**Local:** It was recorded from Fayoum area (Gardner, 1932).

**World:** Morocco, Algeria, Libya, Sudan, Ethiopia, Uganda, Europe, North and South America, New Zealand and Australia.

**Status:** Extinct from Egypt.

## 32. *Pisidium nitidum* Jenyns, 1832





**L = 3.0 mm**

### Synonyms

*Pisidium contortum* Prime, 1854,

*Pisidium personatum* Malm, 1855,

*Pisidium pauperculum* Sterki, 1896.

### Description

Shell is oval to suboval and rather compressed. Umbo is nearly median, broad and not prominent. Upper margin is slightly curved, forming an angle with the posterior and anterior margins. Shell is of median thickness, with a silky lustre and not porous. Striae are moderately fine, uniform and distinct. Hinge is long of moderate width and somewhat curved. The three deep grooves surrounding the umbo, which are the main characteristic of European populations, are absent in African specimens. Cardinal teeth are long, running parallel in the right valve.

**Size:** Average dimensions are 3(L), 2.6(H), 1.8(W) mm.

### Habitat

All types of lotic and lentic ecosystems and muddy bottom.

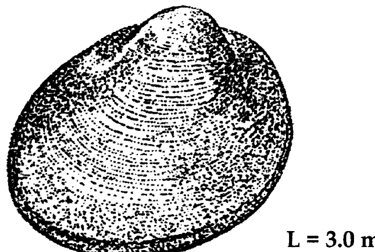
**Distribution**

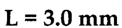
**Local:** It was recorded from Fayoum area (Gardner, 1932, Van Damme, 1988).

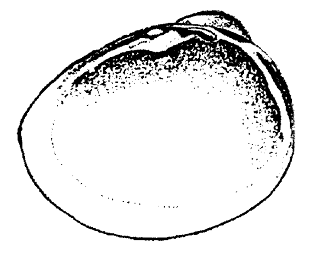
**World:** Morocco, Algeria, Tunesia, Libya, Uganda, England, Sweden and North America.

**Status:** Extinct from Egypt.

## 33. *Pisidium subtruncatum* Malm, 1853





**Synonyms**

*Tellina henslowanum* Leach., 1825,

*Pisidium landeroini* Germain, 1909,

*Pisidium henslowanum* Favre, 1927.

**Description**

Shell is obliquely oval, inflated and very finely striated. Dorsal margin is curved, with the strongest curvature anteriorly. Umbo is pointed, convex and situated near the posterior margin. Anterior cardinal tooth of the left valve is short, slightly curved or straight. Posterior cardinal tooth of the left valve is parallel to the anterior one but normally twice as long. The cardinal tooth of the right valve is relatively long and slightly curved. Lateral anterior and posterior teeth of the right valve are well developed. The anterior lateral tooth of the left valve is more robust than the posterior one. The anterior outer lateral tooth and the posterior one are short, little developed and narrow.

**Size:** Average dimensions are 3.3(L), 2.6(H), 2.0(W) mm, but not larger than 3.0 mm in Africa.

**Habitat**

Muddy ponds, lakes, bays and streams with vegetation.

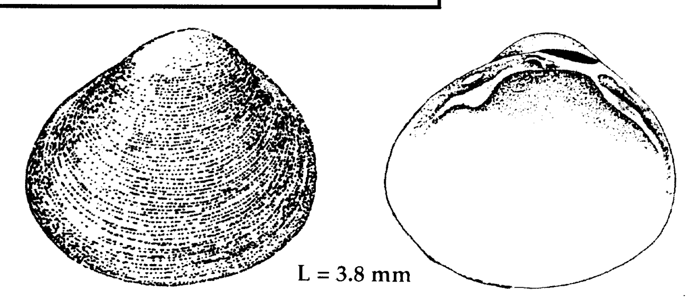
**Distribution**

**Local:** It was recorded from Fayoum area (Gardner, 1932; Van Damme, 1988).

**World:** Morocco, Algeria, Europe (north of Alps) and North America.

**Status:** Extinct from Egypt.

## 34. *Pisidium kenianum* Preston, 1911




**Synonyms**

*Pisidium clarckeanum* G. and H. Nevill, 1871,

*Sphaerium kigeziense* Preston, 1912,

*Pisidium katangense* Rilsbry and Bequaert, 1927.

**Description**

Shell is triangulate to subtriangulate and moderately inflated. Umbo is broad and prominent. Dorsal margin is relatively short and distinctly more curved than the ventral margin. The sculpture consists of fine and distinct striations. Hinge plate is solid. The anterior cardinal tooth of the left valve is curved and its anterior part is parallel with the margin of the hinge plate, while the posterior cardinal one is straight. The cardinal tooth of the right valve is well developed, bent and broadest posteriorly. Lateral anterior teeth of the left and right valves are well developed. The anterior outer lateral tooth of the right valve is short and small, while the posterior outer lateral tooth of the right valve is broader towards its proximal end.

**Size:** Average dimensions are 3.8(L), 3.2(H), 1.2(W) mm.

**Habitat**

In rivers, brooks and ponds.

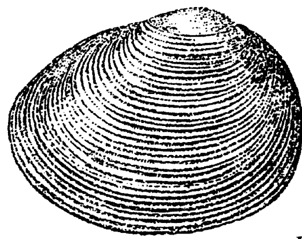
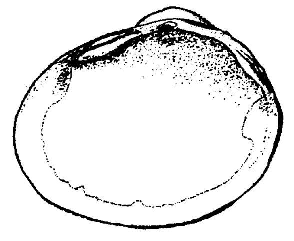
**Distribution**

**Local:** It was recorded from Fayoum area and some localities near Alexandria (Gardner, 1932).

**World:** Central and East tropical Africa; from Ethiopia to Zambia and Kenya.

**Status:** Extinct from Egypt.

## 35. *Pisidium pirothi* Jickeli, 1881

L = 3.2 mm

### Synonyms

*Pisidium casertanum* var. *alexandrina* Pallary, 1909,

*Pisidium costulosum* Haas, 1936,

*Pisidium clarckeanum* var. *exilis* Favre, 1943,

*Pisidium victoriae* Mandahl-Barth, 1954,

*Pisidium lepus* Kuiper, 1957.

### Description

Shell is elongated, with a strongly curved ventral and weakly curved dorsal margin. The sculpture consists of fine and regular striations. Hinge plate is long strongly curved posteriorly, narrowing below the beaks. The anterior cardinal tooth of the left valve is usually straight, while the posterior one is rather long, weakly curved and somewhat enlarged posteriorly. Posterior lateral teeth of the right valve are weakly developed and the posterior lateral tooth of the left valve is less developed than the anterior one. The anterior lateral teeth of the right valve are well developed and arched.

**Size:** Average dimensions are 3.2(L), 2.7(H), 1.9(W) mm.

### Habitat

It is an Afrotropical species, found in all types of permanent waters in Africa.

### Distribution

**Local:** Nile Delta (Kuiper, 1964).

**World:** Niger, Mali, Chad and South Africa.

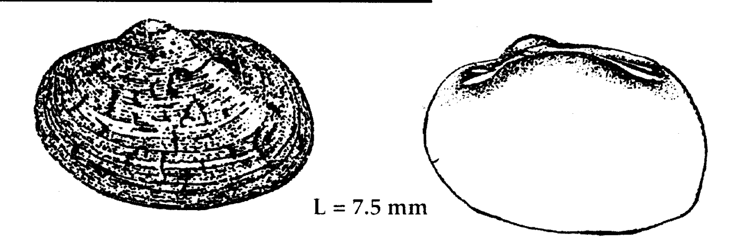
**Status:** Rare.

## Genus *Eupera* Bourguignat, 1854

The shell is small, oblong with the beaks distinctly in front of the middle and frequently with black spots. The cardinal teeth are reduced to one tiny tooth in each valve or in the left valve only. The siphons are united near the base.

Five or perhaps six species are known from Africa (Mandahl- Barth, 1988), but more species cannot be excluded.. Only one species occurs in Egypt.

### 36. *Eupera ferruginea* (Krauss, 1848)




**Synonyms**

*Cyclas ferruginea* Krauss, 1848,

*Eupera parasitica* Deshayes, 1854,

*Pisum parasiticum* Deshayes, 1854.

**Description**

Small, thin, rectangular to suboval shells with an almost medially situated beak. It differs from *Sphaerium* and *Pisidium* by its more rectangular form and straight dorsal margin but mainly by the reduction of the cardinal teeth which are only visible, if present, as a small prominence.

**Size:** Its average size is 7.5(L), 5.0(H), 3.2(W) mm.

**Habitat**

Stagnant waters.

**Distribution**

**Local:** Upper and Lower Nile.

**World:** Niger-Senegal rivers, Lake Chad, Lake Tana (Ethiopia), Rhodesia, South Africa, Madagascar and Mauritius.

**Status:** Rare.

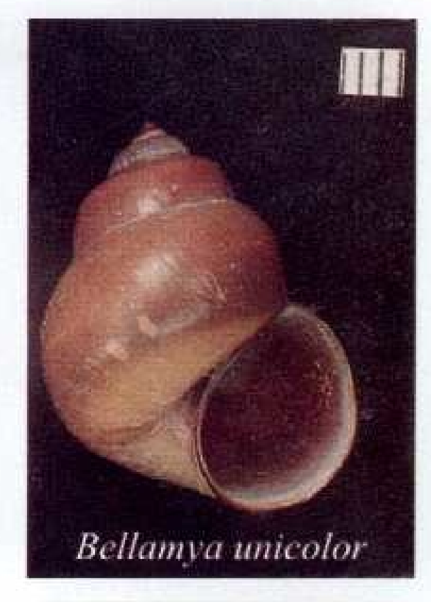
# Coloured Plates

# GASTROPODS

## Plate 1



*Theodoxus (Neritaea) niloticus*



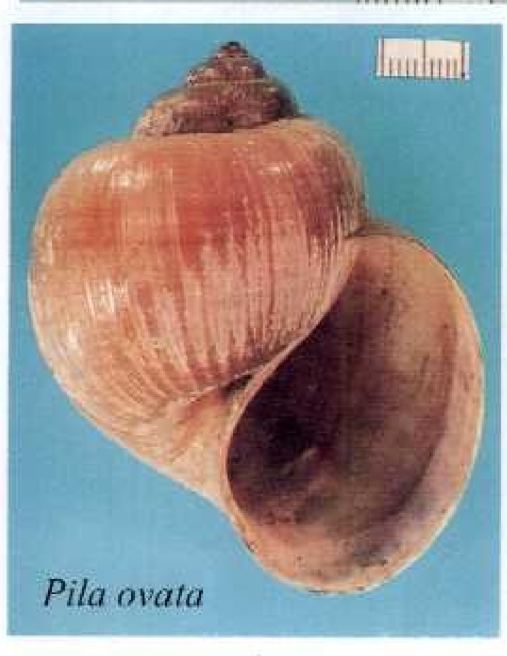
*Bellamya unicolor*



*Lanistes carinatus*



*Lanistes varicus*



*Pila ovata*

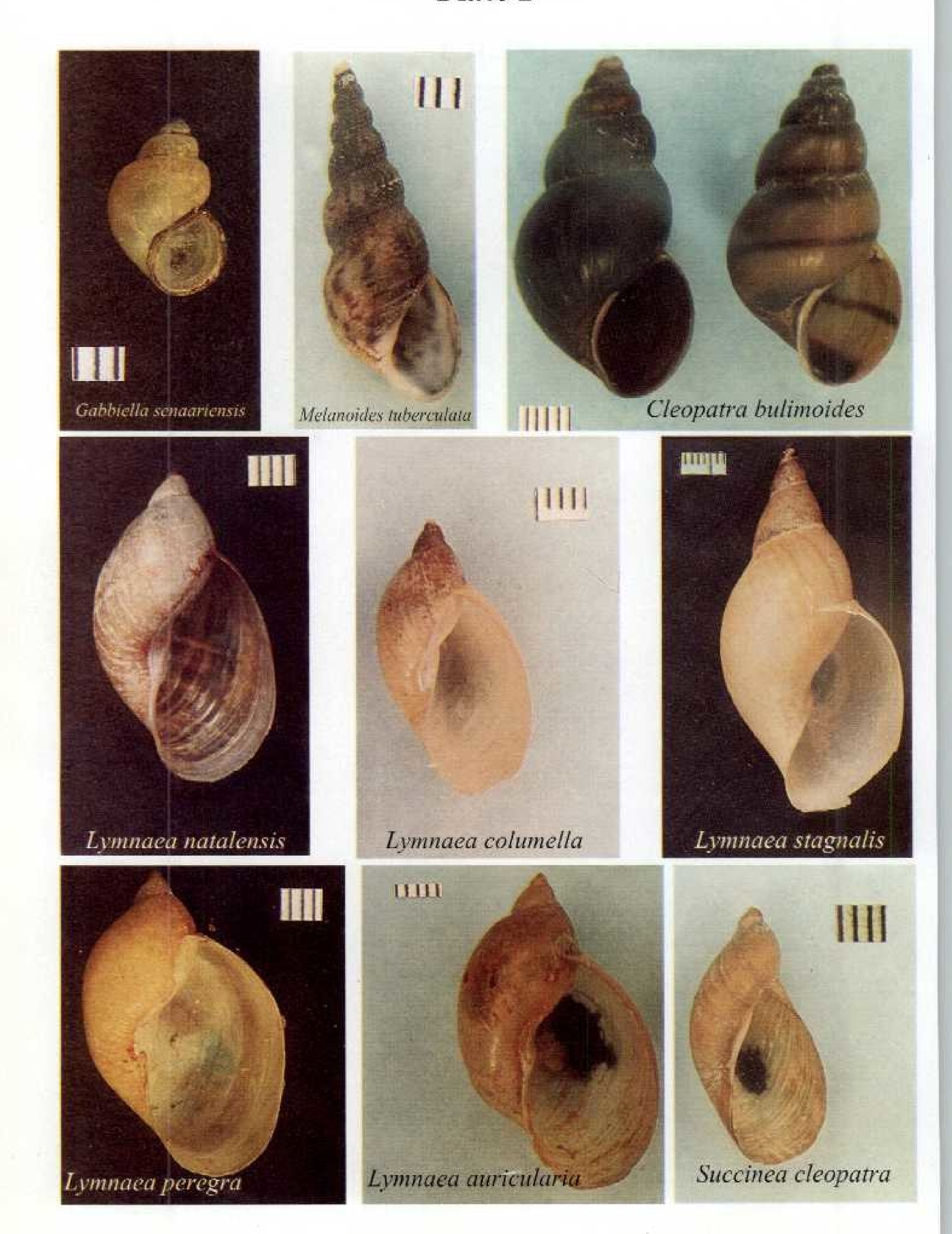


*Pila wernei*



*Valvata nilotica*

## Plate 2



Gabbiella senaariensis
Melanoides tuberculata
Cleopatra bulimoides
Lymnaea natalensis
Lymnaea columella
Lymnaea stagnalis
Lymnaea peregra
Lymnaea auricularia
Succinea cleopatra

# Plate 3


Planorbis planorbis


Gyraulus ehrenbergi

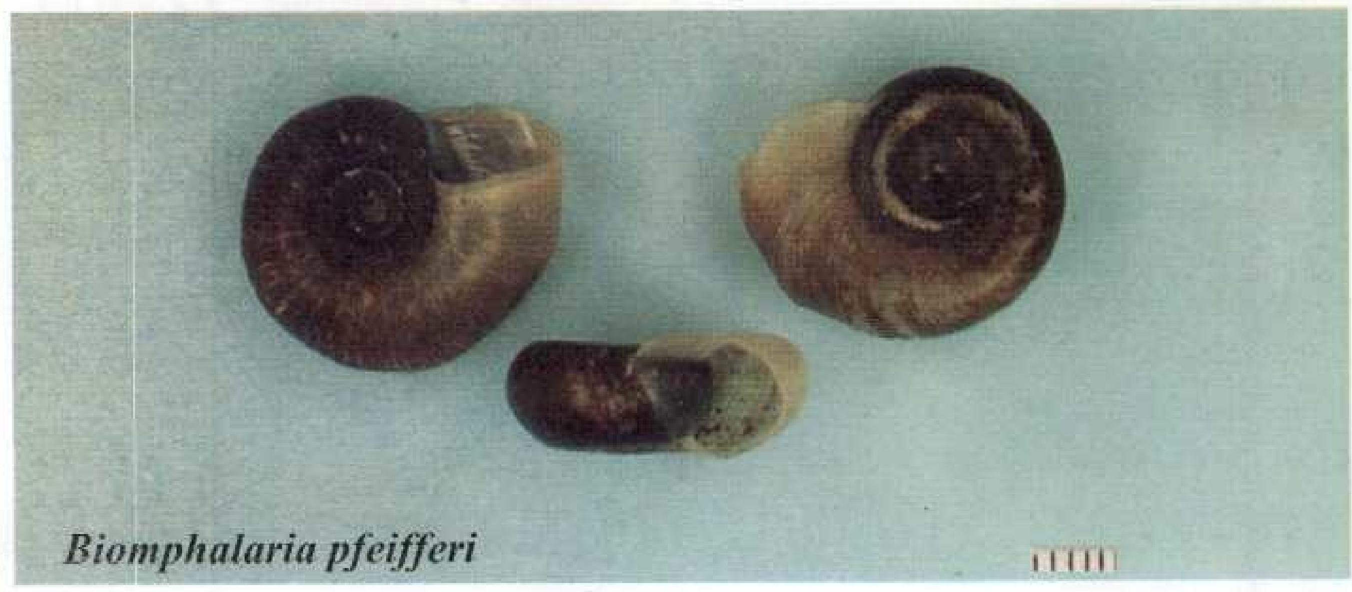

Segmentorbis angustus


Helisoma duryi

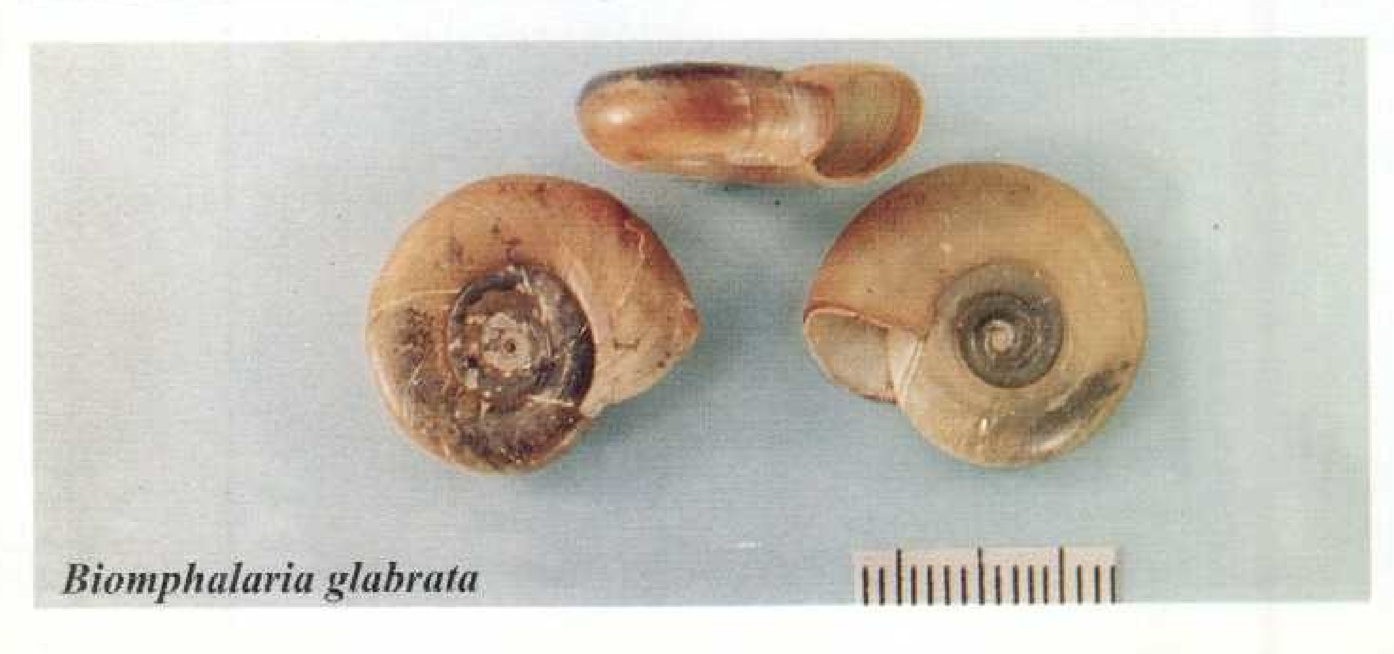
# Plate 4



*Biomphalaria alexandrina*

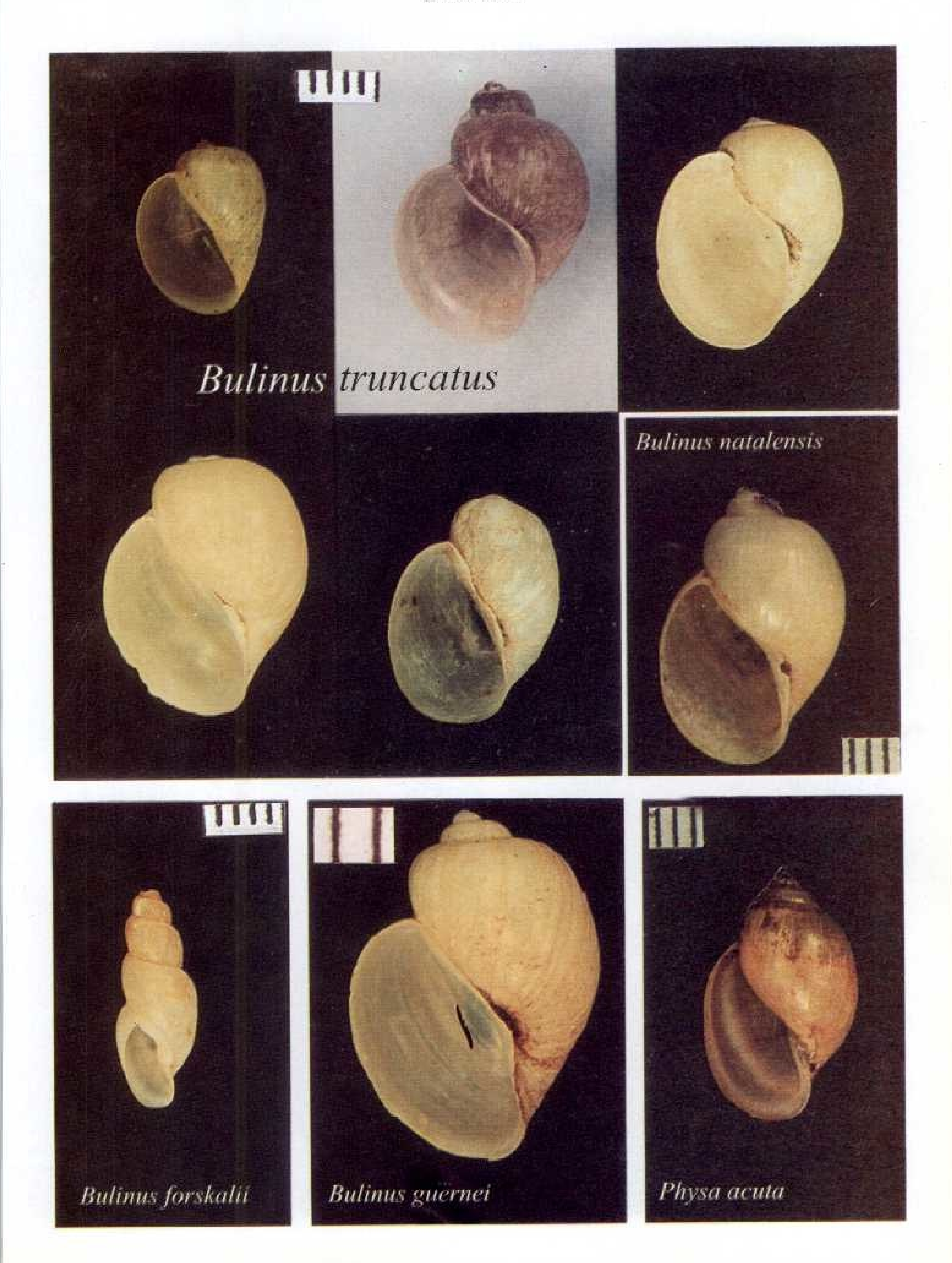


*Biomphalaria pfeifferi*



*Biomphalaria glabrata*

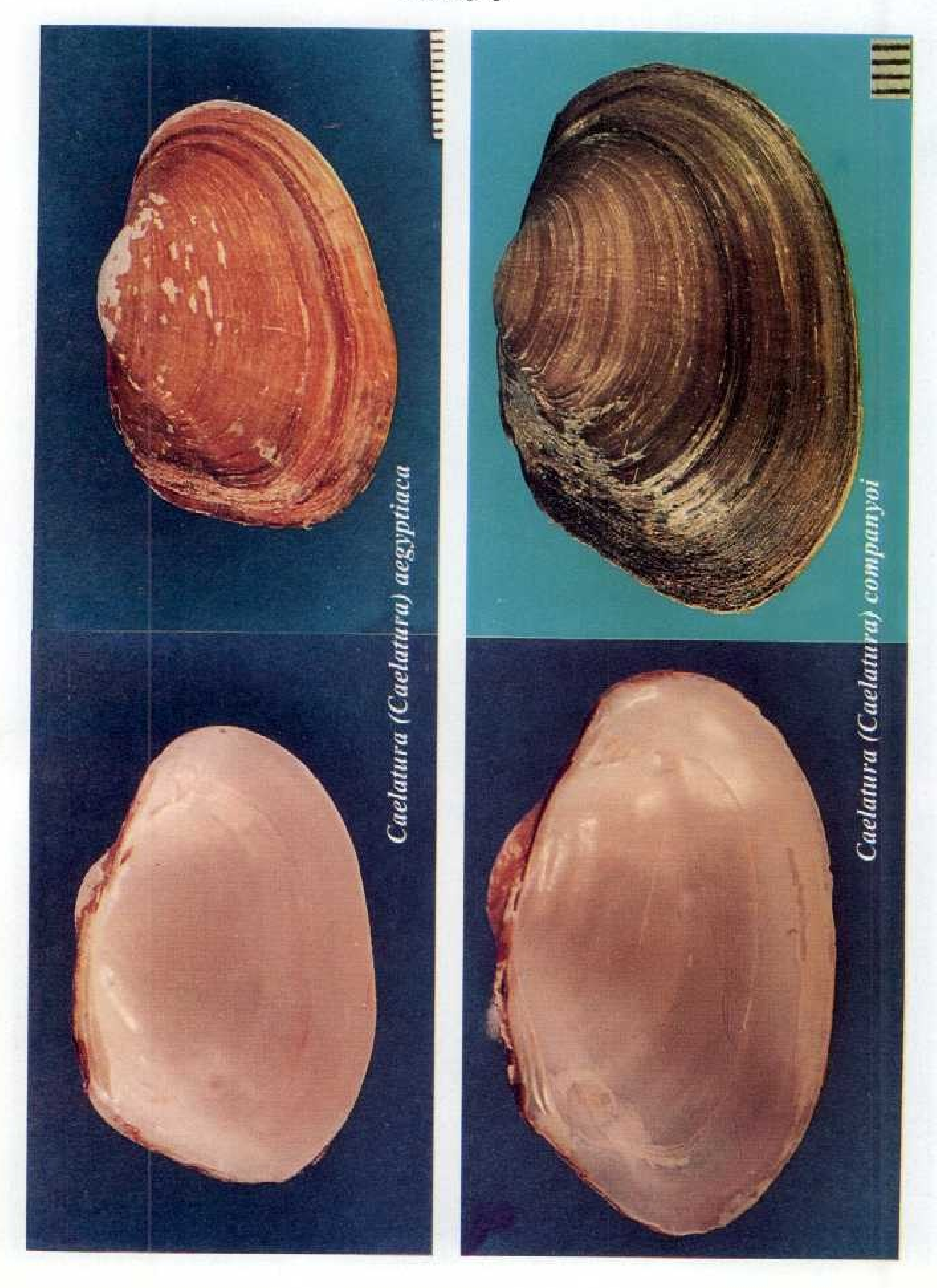
## Plate 5



Bulinus truncatus
Bulinus natalensis
Bulinus forskalii
Bulinus guërnei
Physa acuta

# PELECYPODS

## Plate 6



*Caelatura (Caelatura) aegyptiaca*

*Caelatura (Caelatura) companyoi*

# Plate 7



Caelatura (Caelatura) canopicus
Caelatura (Caelatura) prasidens

# Plate 8



*Caelatura (Caelatura) masranus*
*Caelatura (Caelatura) emeterus*

# Plate 9



**Plate 10**



Caelatura (Iaronia) monereus
Caelatura (Iaronia) gaillardoti

# Plate 11

*Caelatura (Horusia) parreyssi*



*Caelatura (Horusia) anergus*

# Plate 12

*Caelatura (Horusia) bourguignati*



*Caelatura (Horusia) petrettinii*

# Plate 13

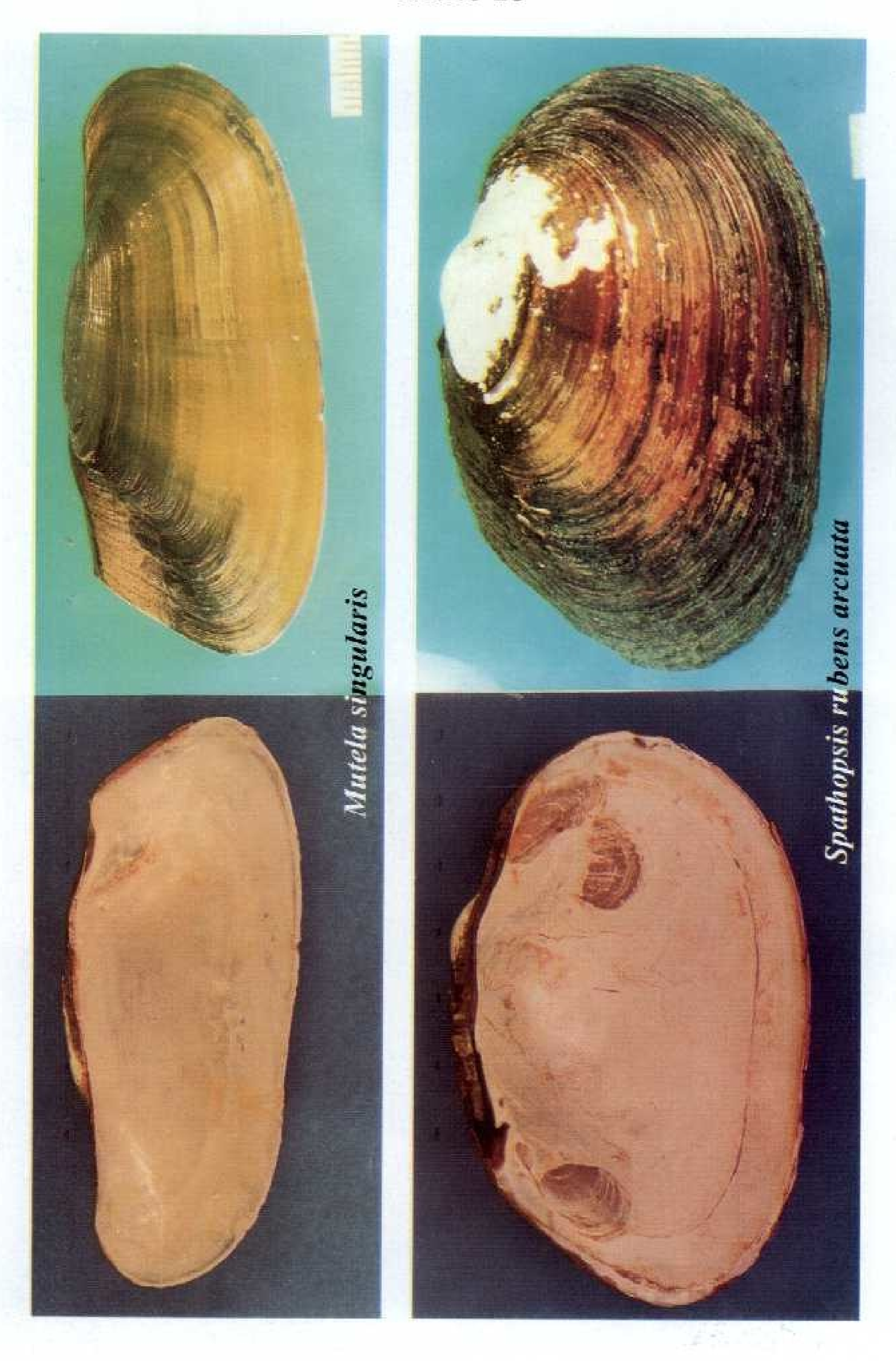
*Caelatura (Horusia) aenodus*

*Sphaerium (Musculium) hartmanni*

# Plate 14



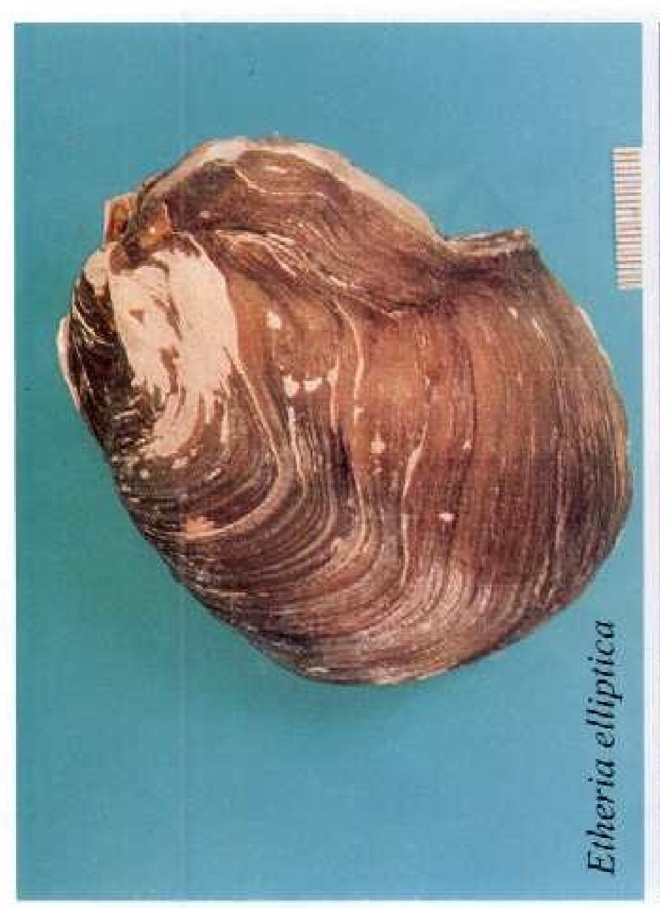
# Plate 15



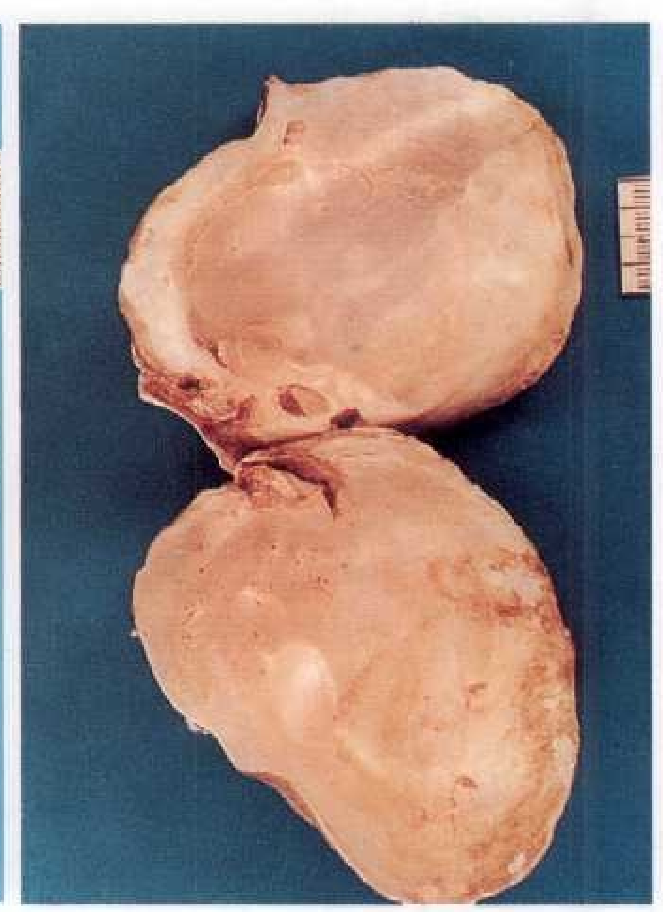
*Mutela singularis*

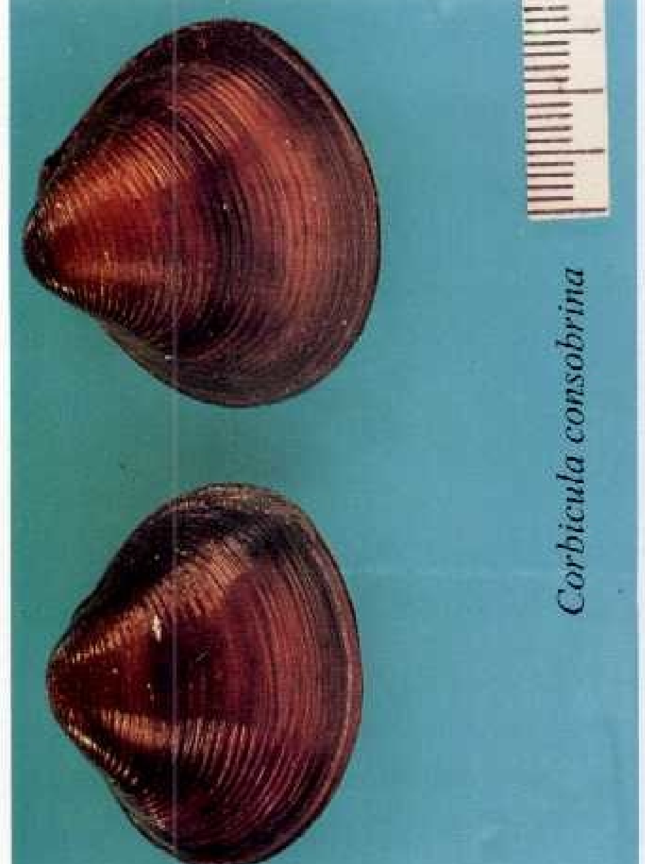
*Spathopsis rubens arcuata*

# Plate 16

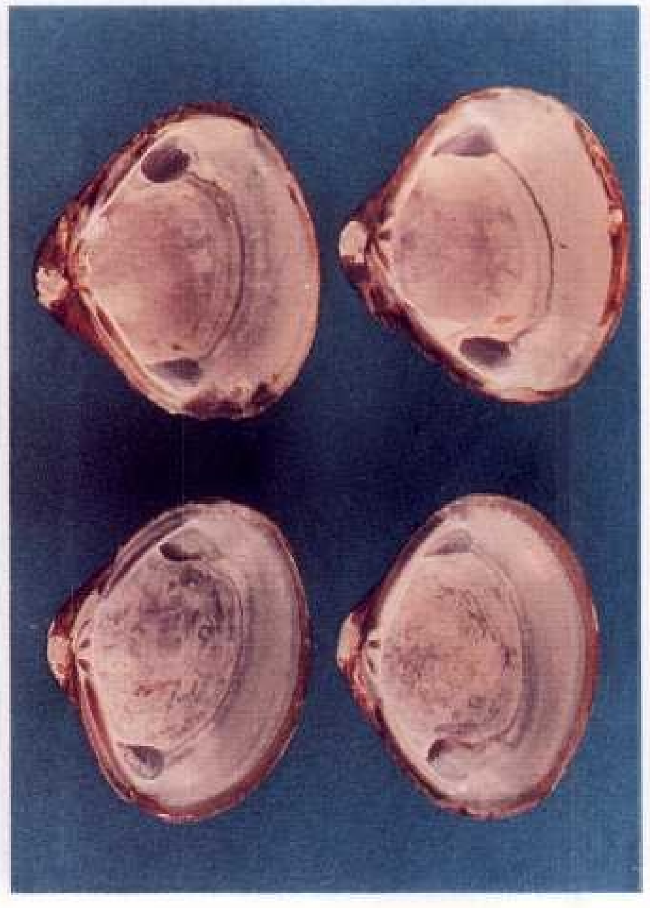


*Etheria elliptica*





*Corbicula consobrina*



# Selected References



## SELECTED REFERENCES

**Abdel-Aal, Z. 1979.** Studies on gastropod Mollusca in El-Mansoura district. M.Sc. Thesis. Fac. of Sci., El- Mansoura Univ. 180 pp.

**Abdelmordy, M. B., Sleem, S. H. and Tantawi, T. A. 1997.** Isozyme polymorphism of esterases in the genus *Lanistes* (Mollusca: Prosobranchiata) and genetic analysis of populations. Biochem. Genet., 35(3/4) :77-89.

**Adenson, M. 1757.** Histoire Naturelle du Senegal (Coquillages).

**Apley, M. L. 1970.** Field studies on life history, gonadal cycle and reproductive periodicity in *Melampus bidentatus* (Pulmonata: Ellobiidae). Malacologia, 1970, 10(2): 381-397.

**Arkell, A. J. 1953.** Shaheinab. An Account of the Excavation of Aneolithic Occupation Site Carried out for Sudan Antiquities Service in 1949-1950. Oxford University Press, London :26.

**Audouin, V. 1827.** Explication sommaire des planches des Mollusques dont les dessins ont ete fournis. M.J.C. Savigny pour "L'Histoire Naturelle de L'ouvrage", in: Description de l'Egypt. 2nd ed., XXII, 112-117.

**Bacci, G. 1951/52.** Elementi per una malacofauna dell'Abissina Y della Somalia, Ann. Mus. Stor. Nat. Genova, 60 : 1-144.

**Barsoum, H. H. 1987.** Biological and ecological studies on some snails and associated plants in the Nile water in Egypt. M. Sc., Afr. stud., Dept. Nat. Res., Cairo University.

**Beadle, L. C. 1974.** The Inland Waters of Tropical Africa. An Introduction to Tropical Limnology. Longman, London , 323 pp.

**Beck, H. 1837.** Index Molluscorum Praesentis Aevi Musei Principis Augustissimi Christiani Frederici.

**Bell, S. V. 1966.** The species of *Pila* R ding occurring in the Sudan. Sudan Notes and Records, Khartoum, 47: 164-181.

**Berrie, A. D. 1970.** Snails, schistosomes and systematics: some problems concerning the genus *Bulinus*. In: "Advances in Parasitology." 8 : 183-188.

**Bishai, H.M., Abdel Malek, S.A. and Khalil, M.T. 1999.** Lake Nasser : a Treatise. Publ. Nat. Biod. Unit, Egyptian Environmental Affairs Agency, No. 11 (In Press).

**Bitakaramire, P. K. 1968.** The survival of *Lymnaea natalensis* in drought conditions. Bull. Epizool. Dis. Afr. 16 : 473-475.

**Blanckenhorn, M. 1901.** Neues zur geologie and palaeontologie Aegyptens. IV: Das Pliocan und Quartarzeit atter in Aegypten ausschlieslicht das Rohten Meorengebietes. Z. Dtsch. Geol. Ges., 53:307.

**Boeters, H. D. 1976.** Hydrobiidae Tunesiens. Arch. Moll., 107: 89-105.

**Bourguignat, J. 1856.** A menites malacologiques, I. Paris

**Bourguignat, J. 1862.** Paleontologie de Mollusques Terrestres et Fluviatiles de l'Algerie. Paris : 121 pp.

**Bourguignat, J. 1864.** Malacologie de l'Algerie, 2 vol., Paris.

**Bourguignat, J. 1881.** Matériaux Historiques sur les Mollusques. Acephales du Systéme Européen. I, Paris.

**Bourguignat, J. 1883 .** Histoire Malacologique de l' Abyssinie. Ann. Sci. Nat. 15 : 47-162.

**Bourguignat, J. 1888.** Iconographic Malacologique des Animau Mollusques du Lac Tanganyika, Paris.

**Bourguignat, J. 1890.** Histoire malacologique du Lac Tanganyika. Ann. Sci. Nat. Zool. 10 : 1-267.

**Browing, E. 1966.** Toxicity of Industrial Metals. 2nd Ed. London Butterworths. Ch. 3 & 4.

**Brown, D.S. 1965.** Freshwater Gastropod Mollusca from Ethiopia. Bull. Nat. Hist. Zool. 12 : 37-94.

**Brown, D.S. 1973.** New species of freshwater Pulmonata from Ethiopia.Proc. Molac. Soc., 40 : 369-378.

**Brown, D. S. 1974.** A Survey of the Mollusca of Lake Chad, Central Africa. Appendix A.

**Brown, D. S. 1980.** Freshwater Snails of Africa and their Medical Importance. Taylor & Francis, London : 1-433.

**Brown, D. S. 1983.** Identification Key of the Freshwater Snails in Countries of the WHO Eastern Mediterranean Region. Copenhagen , 44 pp.

**Brown, D. S. and Wright, C. A. 1980.** Molluscs of Saudi Arabia, Freshwater Molluscs. Fauna of Saudi Arabia 2: 341-358.

**Brown, D. S.; Fison, T.; Southgate, V.R. and Wright, C.A. 1984.** Aquatic snails of the Jonglei region, Southern Sudan and transmission of trematode parasites. Hydrobio., 110 : 247-271.

**Burch, J. B. 1985.** Handbook on Schistosomiasis and other Snail-Mediated Diseases in Jordan. Ann Arbor, Michigan, U.S.A. and Amman, Hashemite Kingdom of Jordan, 224 pp.

**Cailliaud, F. 1823.** Atlas II to voyage à Méroé.

**Cailliaud, F. 1826.** Voyage à Méroé Flauve Blanc au Dela de Fazogl dans le Midi du Royaume de Sennar, a Syouah et dans cinq autres oasis 1819-1822. 4 vols. Imprimarie Royale de Paris.

**Cailliaud, F. 1827.** Voyage a Méroé et au Fleuve Blanc. IV.

**Charke, A. H. 1973.** The freshwater molluscs of the Canadian interior basin. Malacologia, 13 (1-2):1-509.

**Charpentier, J. de. 1837.** Catalogue des mollusques terrestres et fluviatiles de la Suisse (Neue Denkschriften der Allgemeina Schweizerische Gesellschaft fur die gesammten Naturwissene-nschaften, I.).

**Chemnitz, J.H. 1786.** Neues Systematisches Conchylien, Cabinet IX.

**Chevallier, H. 1969.** Mollusques subfossiles récoltés par M. Henri Lhote dans le Sud Oranais et la Sahara. Bull. Mus. Nat. Hist. Paris., 41: 266-294.

**Connolly, M. 1931.** Description of new non-marine Mollusca from North, South and Central Africa, with notes on other species. Ann. Mag. Nat. Histo. 10, B: 305-322.

**Cox, L. R. 1933.** A lower tertiary siliceous rock from the Anglo-Egyptian Sudan. Bull. Inst. Egypt, 15 : 315-348.

**Crawford, G. I. 1949.** The Armstrong College Zoological Expedition to Siwa Oasis (Lybian-desert), 1953: Mollusca. Proc. Egyptian Acad. Sci., 4: 45-58.

**Daget, J. 1961.** a. Note sur les *Spathopsis* (Mutelidae) de L'Quest Africaiin. J. Conch. Paris, 101: 63-77.

**Daget, J. 1964.** Note sur les *Mutela* (Mutelidae) de L'Quest African. Mém. Inst. Franc. Afr. noire., 104 : 3-14.

**DBL. 1973.** A field guide to African freshwater snails. 2. East African species. WHO Snail Identification Centre, Danish Bilharziasis Laboratory, Charlottenlund. Denmark : 1-51.

**DBL, 1983.** A field guide to freshwater snails in countries of the WHO Eastern Mediterranean region. WHO Snail Identification Centre, Danish Bilharziasis Laboratory. Charlottenlund Copenhagen: 1-45.

**Dejoux, C., Lauzanne, L. and Lévèque, C. 1971.** Prospection hydrobiologique du Lac de Léré (Tchad) et des mares a voisinantes, 4. Faune benthique. Cah. Off. Rech. Sci. Tech. Outre-Mer, Sér. Hydrobiol., 5: 179-188.

**Deligiannis, A., Kozlakidou, S. and Stylianon, L. 1986.** Heavy metal and mineral matter load in the water and sediments of the Axios River in Northern Greece. Abvasser, 33 (7): 592-594.

**Demian, E. S. 1954.** The macroscopic anatomy of *Lanistes carinatus* Oliver. M.Sc. Thesis Fac. of Sci., Ain Shams University, Cairo.

**Demian, E. S. 1957.** Morphological and biological studies on some freshwater gastropods of Egypt (the Planorbidae) with special reference to *Bulinus truncatus*. Ph.D. Thesis, Fac. of Sci., Ain Shams Univ.

**Demian, E. S. 1959a.** On the freshwater gastropods of the Bahariya Oasis. Ain Shams Sci. Bull., Cairo, 4: 123-135

**Demian, E. S. 1959b.** On the freshwater gastropods of the Dakhla and Kharga Oases. J. Zool. Soc. Egypt, 14: 17-20.

**Demian, E. S. 1960.** Morphological studies on the planorbidae of Egypt. 1. On the macroscopic anatomy of *Bulinus (Bulinus) truncatus* (Audouin). Ain Shams Science Bulletin, Faculty of Science, Cairo, 5: 1-84.

**Demian, E. S. 1962.** *Anisus oasiensis* n. sp. A new planorbid species from Egypt. Arkiv for Zoologi, 15 (8): 149-162.

**Demian, E.S. and Ibrahim, A.M. 1965.** Anatomy of *Limnaea caillaudi* Bourguignat, the transmitter of fascioliasis in the UAR. I. The reproductive system. Proc. Egypt, Acad. Sc., 19 : 21-29

**Devilliers, C. and Peres, J.M. 1939 .** Notes sur quelques gisements de coquilles fluviatiles du Sahara central. Bull. Mus. Hist. Nat. Paris. 2e Sér., 11 : 473-478.

**Dumont, H. 1979.** Limnologie van de Sahara en Sahel. (unpubl. D. Sc. thesis), Ghent, 557 pp.

**Egglishaw, H. J. 1964.** The distributional relationship between the bottom fauna and plant detritus in streams. J. Anim. Ecol. 33: 463-476.

**Ehrenberg, C. G. 1831.** Symbolae Physicae Animalia Evertebrata Exclusis insectis. Series I, Dec. 1.

**El-Gindy, M. S. 1957.** Distribution and ecology of the snail vectors in schistosomiasis, compiled review on schistosomiasis in Egypt. J.Egypt. Med. Assoc., 40: 192-204.

**Elewa, A. S. and Mahdi, H. 1988.** Some limnological studies on the Nile water at Cairo, Egypt Bull. Inst. Oceanogr. & Fish., ARE., 14 (2): 141-152.

**Férussac, A. E. 1823.** Notice sur les Aethéries trouvées dans le Nil par M. Cailliaud. Mém. Soc. Hist. Nat. Paris, 1: 353-365.

**Fischer, P. 1878.** Coquilles du Sahara, provenant du voyage de M.L. Say. J. Conch. Paris., 18 :73-82.

**Fischer, P. 1891.** Mollusques. In: "L'extreme sud Algerien. Contributions a l'Histoire Naturelle de Cette Region." (J. Dybowski, ed.). Nlles Arch. Miss. Sc. Litt., 1: 361-368.

**Fischer-Piette, E. 1949.** Mollusques terrestres et fluviatiles recoltes par Th. Monod dans le Sahara occidental. J. Conch., Paris, 89: 231-239.

**Fryer, G. 1961.** The developmental history of *Mutela bourguignati* (Ancey). Phil. Trans. Roy. Soc. London, 244: 259-298

**Gardner, E. W. 1932.** Some lacustrine Mollusca from the Fayoum depression. A study in variation. Mem. Inst. Egypte., 18 : 1-123.

**Gautier, A. 1970.** The freshwater molluscs from the Chiwondo Beds (Malawi). A preliminary Report. Quaternaria, 13 (3): 325-330.

**Gautier, A. 1980.** Contributions to the Archaic Zoology of Egypt. In: "Prehistory of the Eastern Sahara". Wendorf, F.and Schild, R. (edit) pp:317-339. Academic Press, New York.

**Germain, L. 1905.** Contributions à la faune malacologique de l' Afrique equatoriale. Note sur quelques mollusques nouveaux du Lac Tchad et du bassin du Chari. Bull. Mus. Hist. Nat. Paris., 11: 483-489.

**Germain, L. 1907.** Contributions a la faune malacologique de l'Afrique equatoriale. IX. Mollusques nouveaux de l'Afrique centrale. Bull. Mus. Hist. Nat. Paris., 13 : 64-68.

**Germain, L. 1909.** Contributions 19. Mollusques nouveaux de l'Afrique tropical. Bull. Mus. Hist. Nat. Paris., 15: 375-378.

**Germain, L. 1916.** Seconde notice malacologique. In: "Documents Scientifiques Mission Tilho, T". (Tilho, S. ed.) 3, Paris, ed. Larose: 282-322.

**Germain,L. 1919.** Sur les Lymnées africaines. Bull. Mus. Hist. Nat. Paris, 318-324.

**Germain. L. 1920.** Mollusques Terrestres et Fluviatiles. In "Voyage de M. Guy Babault dans l'Afrique Orientale Anglaise". Paris.

**Germain, L. 1929.** Mollusques fluviatiles recueillis, M. le Prof. E. Brumpt dans la Soudan Anglo-Egyptian. Bull. Mus. Hist.Nat.Paris, 410-418.

**Germain, L. 1932.** Mollusques terrestres et fluviatiles recevillis, M. le Lieutenant Boery a Oualata (Sahara Soudanais). Bull. Comit. Etudes. Hist.Scient. A.O.F., 14 (3): 1-49.

**Gmelin, J. F. 1790.** Systema Naturae. 13, I, Part 6. Leipzig.

**Haas, F. 1969.** Superfamilie Unionacea. Das Tierreich Berlin, 88: 1-663.

**Hubendick, B. 1951.** Recent Lymnaeidae. Their variation, morphology, taxonomy, nomenclature and distribution. Kungl. Sv. Vetenskapsakademins Handl. Ser. G., 3 (1): 1-223.

**Ibrahim, A.M. 1975.** On the molluscan fauna of the Siwa Oasis. Bull. Zool. Soc. Egypt, 27: 71-77.

**Ibrahim, A.M. and Yousif, F. 1983.** The freshwater ampullariid snail *Lanistes carinatus* as a natural intermediate host of *Angiostrongylus cantonensis* in Egypt. J. Egypt. Soc. Parasit., 13 (1) : 117-124.

**Ibrahim, A.M., El-Alfy, S. and Abdalla, S. 1988.** Radiobiological studies involving gamma irradiation on the snail *Biomphalaria alexandrina*. First Int. Conf. Env. Studies and Res., 3 : 912- 926.

**Ibrahim, A. M, Khalil, M. T. and Mubarak, F.M. 1995.** On the feeding behaviour of the exotic crayfish *Procambarus clarkii* in Egypt and its prospects in the biocontrol of local vector snails. J.Union. Arab Biol, Cairo, 4 (A): 321-340.

**Ishak, M. M.; Awad, E.I.; Borhan, M.A.; Shehata, M.B.; Kheir, M.S. and Dawood, W.L. 1979.** Water Quality Studies on the River Nile and Lake Nasser: Studies on the River Nile Ecosystem. Acad. Sc. Res. & Techn. Egypt and University of Michigan, 80 pp.

**Ishak, M. M., El-Ayoty, E., El-Sedfy, H.H., Shehata, M.B., Awaad, E.E., Borhan, M.A. and Ibrahim,I.F. 1976.** Some studies on River Nile ecosystem.(Report). Inst. of Oceangr. & Fish., Acad. of Sc. Res. & Tech. Egypt., 77 pp.

**Iskaros,I.A. 1988.** Biological studies on bottom fauna of Lake Nasser and adjacent waters. M.Sc. Thesis, Fac. of Sci., Alex. Univ., 184 pp.

**Itagaki, H. and Yasuraoka, K. 1975.** Anatomy of *Bulinus* (*B.*) *truncatus* from the Fezzan area in Libya and its ecological note. Jap. J. Malc. (Venus)., 34: 33-47.

**Jaeckel S.H. 1972.** Quartáre Mollusken aus dem ehemaligen Tschad-Binnensee. In Bötcher *et al.*, 224-226.

**Jickeli,C.F. 1874.** Fauna der Land und Süsswasser - Mollusken Nord-Ost Africa's. Nova Acta Acad. Caesar. Leop. Carol., 37: 1-352.

**Jousseaume, F. 1886.** Coquilles du Haut-Sénégal. Bull. Soc. Zool. France., 11: 471-502.

**Kajak, Z. 1977.** Factors influencing benthic biomass in shallow lake environments. Ekol. Pol., 25 (3): 421-429.

**Kobelt, W. 1899.** Rossmassler's Iconographie der Land-und Süss -Wasser-Mollusken. (Neue Folge VIII).

**Kossa, I. F. 1981.** Biological studies on some protozoan animals found in association with habitats of freshwater molluscs. M. Sc. thesis, Faculty of Science, Ain Shams Univ., Cairo.

**Krauss, F. 1848.** Die Sud afrikanisches Mollusken. Stuttgart.

**Kuiper, J. G. J. 1972.** Une recolte de *Pisidium* dans le Moyen Atlas. Resultats de la mission biologique au Maroc de l'Universite de Gand, Belgique. Belgioque, No. 9, Basteria 36: 189-198.

**Lamarck, J.B. 1807.** Sur l'Aethérié nouveau genre de conquille bivalve de la famille de Camacés. Ann. Muss. Hist. Nat., 10: 398-408.

**Lea, J. 1838.** Description of new freshwater and land shells. Trans. Amer. Phil. Soc. N.S., 6: 1-154.

**Leigh, E.G. and Butzer,K.W. 1968.** Fossil molluscs from the Kom Ombo Plain, In: "Desert and River in Nubia". (Butzer, K. W. & Hansen, C. L. eds.), 509-512 pp.University of Wisconsin Press.

**Leiper, R.T. 1916.** Report of the Bilharzia Mission in Egypt, Part IV J. Roy. Arm. Med. Corp., XXVII: 171-189.

**Leloup E. 1951.** Lamellibranches. Explor. Hydrobiol. L. Tanganyika, 3, Fasc., 2: 1-153.

**Lévêque C. 1967.** Mollusques aquatiques de la zone du Lac Tachad. Bull. Inst. Fod. Afr. Noire., 29: 1494-1533.

**Linnaeus. 1758 .** Systema Naturae, ed. 10, I.

**Longstaff, J. 1914.** Molluscs from the Southern Sudan. J. Linn. Soc. Zool., 32: 233-268.

**Malek, E.A. 1958.** Distribution of the intermediate hosts of bilharziasis in relation to hydrography. Bull. WHO., 18: 691-734.

**Malek, E.A. 1959.** Natural and experimental infection of some bulinid snails in Sudan with *Schistosoma haematobium*. In: "Proceeding of the sixth International Congress on Tropical Medicine and Malaria" 2, Anais de Instituto de medicina Tropical, Lisbon 16. Supplement 6: 43 - 52.

**Mandahl-Barth, G. 1954.** The freshwater molluscs of Uganda and adjacent territories. Ann. Mus. R. Congo Belge, 8, Su Zool., 32:1-206.

**Mandahl-Barth, G. 1957.** Intermediate hosts of *Schistosoma,* African *Biomphalaria* and *Bulinus.* 2. *Bulinus*. Ibid., 17 : 1-65.

**Mandahl-Barth, G. 1958.** Intermediate hosts of *Schistosoma*, African *Biomphalaria and Bulinus.* WHO, Geneva; Monograph No. 37.

**Mandahl-Barth, G. 1968.** Freshwater Molluscs. In:Expl. Hydrobiol. Bangweulu, (Symoens, J.J. ed.), Luapula 2. Cercle. Hydrobiologique de Bruxelles : 1-68.

**Mandahl-Barth, G. 1973.** Description of new species of African freshwater molluscs. Proc. Malac. Soc. London., 40: 227-286.

**Mandahl-Barth, G. 1982.** Studies on African Freshwater Bivalves 1. The Unionidae. Danish Bilharziasis Laboratory, Charlottenlund, Denmark: 1-33

**Mandahl-Barth, G. 1988.** Studies on African freshwater bivalves. Danish Bilharziasis Laboratory, Charlottenlund, Denmark.: 1-153.

**Martens E. von 1866.** Ubersicht der Land und Süsswasser Mollusken des Nil. Gebiets Schluss Mal. Bl., XIII: 1-21.

**Martens E.von 1886.** Subfossile Susswasser conchylien ous Aegypten Welche Prof. G. Schwein furth im Faium-Becken unweit Adue uder dem Bats am Bahndomm in 17 m Seehole gesammelt hat (Sitzb. d. Gesellsch. Naturfr. Fnde. Berlin, 126-129).

**Mayer-Eymar,C. 1893.** Le ligurien et le Tongrien en Egypte. Bull. Ins. Egypt, 3 (4): 365-380.

**Menshawy, M. M. 1998.** Ecological and biological studies on the benthic Mollusca of certain segments along the River Nile with special reference to pollution. M. Sc., Zool. Dept., Fac. Science, Ain Shams University, Egypt.

**Monakov, A.V. 1969.** The zooplankton and the zoobenthos of white Nile and adjoining waters in the Republic of the Sudan. Hydrobiol., 33 : 161-185.

**Monod, T. 1958.** Majâbat at Aĺ-Koubrâ. Contribution à l'etude de l' Empty Quarter' Ouest-Saharien, Mém. I.F.A.N., 52: 1-218.

**Newton, R.B. 1912.** On the Lower tertiary Mollusca of the Fayoum Province of Egypt. Proc. Malac. Soc. London., 10 :56.

**Olivier, G.A. 1804.** Voyage dans l'Empire Othoman, l'Egypte et la Perse, III, An.12.

**Pain, T. 1961.** Revision of the African Ampullariidae species of the genus *Pila* Röding, 1788. Ann. Mus. Afr. Centr. Sci. zool., 96: 1-27.

**Pallary, P. 1901.** Mémoire sur les mollusques fossiles terrestres, fluviatiles et saumâtres de l'Algérie. Mém.Soc. Geol. Fr. Paléon. Paris., 22 : 1-206.

**Pallary, P. 1909.** Catalogue de la fauna malacologique d'Egypte, Mem. Inst. Egypt., 6 : 1-92 , 7 : 1-61.

**Pallary, P. 1912.** Etude sure quelques *Melonopsis* du Sahara et de la Tunésie. Mém. Inst. Egypt.,. 3: 14-22.

**Pallary, P. 1924.** Supplément à la faune malacologique terrestre et fluviatile de l'Egypt. Mém.Inst.Egypt. 7: 1-61.

**Pallary, P. 1927.** Compléments à la faune malacologique de la Berbérie (Suite). J. Coch. Paris, 71 : 197-277.

**Philippi, R. A. 1848.** Abbildungen und Beschreibungen never oder wenig gekannter conchylien, II and III Kassel.

**Pielou, E. C. 1975.** Ecological Diversity. Johne Wiley & Sons, New York.

**Piersanti, C. 1940.** Molluschi del Tana della zona finitima Missione di studio al Lago Tana. Vol. III (2): 233-263.

**Pilsbry, H. A. and Bequaert, J. 1927 .** The aquatic molluscs of the Belgian Congo, with a.geographical and ecological account of Congo malacology. Bull. Am. Mus. Nat. Hist., 53: 59-602.

**Preston, H. B. 1910.** Further additions to the molluscan fauna of central Africa. Ann. mag. nat. Hist., 8,6 : 58-64.

**Preston, H. B. 1913.** New species and varieties of terrestrial and fluviatile shells from Equatorial Africa. Rev. Zool. Afr. 1 : 322 - 328.

**Preston, H. B. 1914.** In: "On a Collection of non-marine Mollusca from the Southern Sudan". (Longstaff, J. ed.) , J. Linn. Soc. Zool., 32: 233-268.

**Rochebrune, A. T. de 1886.** Sur quelque lamellibranches nouveaux provenent du Congo et de ses tributaries. Bull. Soc. Malcol. France., 3: 1-14.

**Ryšavý, F; Moravec, F; Baruš, V. and Yousif, F. 1974.** Some helminths of *Bulinus truncatus* and *Biomphalaria alexandrina* from the irrigation system near Cairo. Folia Parasitologica (Praha), 21: 97-106

**Sandford, K. S. 1936.** Observation on the distribution of land and freshwater Mollusca in the southern Libyan Desert. Quat. J. Geol. Soc. London., 92: 201-220.

**Sinclair, I. and Isom, A. 1963.** Further studies on the introduced Asiatic form (*Corbicula*) in Tennessee. Tennessee Department of Public Health : 1-75.

**Smithers, S. R. 1956.** On the ecology of schistosome vectors in the Gambia, with evidence of their role in transmission. Trans. R. Soc. Trop. Med. Hyg., 50: 354-365.

**Van Damme, D. 1976.** Systematiek Ecologie en Evolutic van de Fossiele Zoetwater Mollusken in Het Rudolfmeerbekken (Ethiopie, Kenya). Thesis, Rÿks-Unversiteit, Gent, : 310pp.

**Van Damme, D. 1984.** The Freshwater Molluscs of Northern Africa. W. Junk (Developments in Hydrobiology 25) .

**Van Damme, D. 1988.** Quaternary Distribution, Biogeography, Paleoecology and Evolution of the North African Freshwater Molluscs. State University of Ghent., : 1-165.

**Von Martens, E. 1886.** Subfossile Süsswasser - Conchylien aus Aegypten. Sber. Ges. Naturf. Freunde, Berlin, : 126 pp.

**Watson, J. M. 1958.** Ecology and distribution of *Bulinus truncatus* in the Middle East. Bull. W. H.O.,18:833-894.

**Williams, M. A. J. & Adamson, D. A. 1974.** Late Pleistocene desiccation along the White Nile. Nature. Lond. 248: 584-586.

**Williams, S. N. and Hunter, P. J. 1968.** The distribution of *Bulinus* and *Biomphalaria* in Khartoum and Blue Nile provinces. Sudan. Bull. WHO. 39: 948 - 954.

**Williamson, P. 1981.** Palaentological documentation of speciation in Cenozoic molluscs from Turkana Basin. Nature., 293 : 437-443.

**Yousif, F.; El-Emam, M.; Abdel-Kader, A.; El-Din, A.S.; El-Hommossany, K. and Shiff, C. 1998a.** Schistosomiasis in newly reclaimed areas in Egypt. 1- Distribution and population seasonal fluctuation of intermediate host snails J. Egypt. Soc. Parasitol., 28(32): 915-928.

**Yousif, F.; El-Emam, M. and Sayed, K., 1998b.** Effect of six non-target snails on *Schistosoma mansoni* miracidial host finding and infection of *Biomphalaria alexandrina* under laboratory conditions. J. Egypt. Soc. Parasitol., 28(2): 559-568.

**Yousif, F.; El-Emam, M.; Haroun, N.; Mohamed, S. and Kamel, G. 1991.** Testing of *Echinostoma lei* as a biocontrol agent against *Schistosoma mansoni* under simulated natural conditions. In "Aquacultura and Schistosomiasis" Proc. Meeting held in Manila, Phillipines, Aug. 1991. National Research Council USA. National Acadmy Press, Washington, D.C. : 245-263.

**Yousif, F., El-Emam, M. and Roushdy, M. Z. 1993.** *Helisoma duryi*: its present range of distribution and implications with schistosomiasis snails in Egypt. J. Egypt. Soc. Parasit., 23 (1): 195-211.

**Yousif, F., Haroun, N., Ibrahim, A. M. and El-Bardicy, S., 1996.** *Biomphalaria glabrata* : a new threat for schistosomiasis transmission in Egypt. J. Egypt. Soc. Parasit.,26 (1): 191-205.

**Yousif, F. and Ibrahim, A.M. 1978.** The first record of *Angiostrongylus cantonensis* from Egypt. Z. Parasitenkd. 56 : 73-80.

**Yousif, F. and Ibrahim, A.M. 1979.** Four new Xiphidiocercariae from freshwater prosobranchs in Egypt. J. Egypt. Soc. Parasit. 9 (2) : 411-419

**Yousif, F.; Ibrahim, A.; Abdel-Kader, A. and El-Bardicy, S. 1998a.** Invasion of the Nile Valley in Egypt by a hybrid of *Biomphalaria glabrata* and *Biomphalaria alexanderina* snail vectors. J. Egypt. Soc. Parasitol., 28 (2) : 596-582.

**Yousif, F.; Ibrahim, A. and El-Bardicy, S. 1998b.** Compatibility of *Biomphalaria alexandrina, Biomphalaria glabrata* and a hybrid of both to seven strains of *Schistosoma mansoni* from Egypt. J. Egypt. Soc. Parasitol., 28(3): 863-881

**Yousif, F.; Ibrahim, A. and El-Bardicy, S. 1999.** Differentiation between *Biomphalaria alexandrina, Biomphalaria glabrata* and a hybrid of both, obtained from natural habitats in Egypt (In Preparation)

**Yousif, F,; Kamel, G.; El-Emam, M.; Mohamed, S.N. 1993.** Population dynamics and schistosomal infection of *Biomphalaria alexandrina* in four irrigation canals in Egypt. J. Egypt. Soc. Parasitol, 23(3): 621-630.

**Yousif, F, Mahmoud, M. I. and Barsoum, H. H. 1987**: Biological and ecological studies on some snails and associated plants in the Nile water in Egypt. Dept. of Natural Resources. M.Sc. Thesis, Faculty of Science, Cairo University.

**Zhadin, V. I. 1952.** Mollyuski presnykhi nolonovatykh vod SSSR (Mollusca of fresh and brackish waters of the U.S.S.R.). I.-Zdatel' stvo Akedemii Nauk SSSR 46 : 1-356; In : "Keys to the fauna of the USSSR". Finesilver (ed.) 1965, Israel Program for Scientific Translations Jerusalem, 368 pp.

# Index of Scientific Names

- Accepted names in *italics*
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- Order, class, subclass, family, superfamily, genus and subgenus in **bold type**

رئاسة مجلس الوزراء
جهـاز شـئون البيـئة
ادارة المحميـات الطبيعيـة




# رخويات الميـاه العذبـة فى مصـر

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مطبوعات وحدة التنوع البيولوجى - العدد ١٠ - ١٩٩٩

NAME: PROF. DR. MAGDY TAWFIK KHALIL



**Present Occupation :** Professor of Aquatic Ecology, Zoology Dept., Faculty of Science, Ain Shams University.

**Degrees**

- Ph. D. in 1985, from Syracuse University, N.Y., USA and Ain Shams University., joint supervision.
- M. Sc. in 1978, from Ain Shams University.
- B. Sc. in 1973, from Zoology Dept., Fac. of Science, Ain Shams University.

**Field of Research :** Environmental Sciences, Aquatic Ecology, Biodiversity, Pollution and Limnology.

**Published Articles :** Over 33 papers in international and local specialized journals in the above fields.

**Supervision of theses :** Supervised more than 14 theses for M.Sc. and Ph.D. in the above fields.

**Teaching Experience :**

- Ain Shams University (1973-) lecturing in Malacology, Aquatic Biology, Limnology and General Invertebrates.
- Faculty of Education in Oman (1988-1992).
- United Arab Emirates University, Biology Department (1996-).

**Conferences and Symposia:**

Represented Ain Shams University in 14 conferences and symposia; internationally and locally, such as the Second International Conference for Fish Resources Development in Egypt ( 1986 ); International Symposium for Bioindicators of Pollution, Cairo (1986); Second International Symposium on Tilapia Aquaculture, Bangkok, Thailand (1987); the First National Conference on the Environmental Studies and Research, Cairo (1988); the First International Conference for Trace metals in Lakes, Canada ( 1988); Workshop on Data Management of Biodiversity, Cairo (1995) and the Scientific Research and the Biodiversity in the Arab Countries, Syria (1995).

**Membership of Societies and Organizations:**

Active member in 10 Scientific international and local societies such as the Ecological Society of America, USA; International Center for Living Aquatic Resources Management, Philippines; Zoological Society of Egypt and the Egyptian Association for Conservation of Natural Resources, Egypt.

**Projects:**

Co- researcher of 10 scientific projects such as the Egyptian - American project for developing Lake Qarun (1973-1978); Development of Lake Manzala, under the supervision of UNEP and a Canadian company (1979-1980); American project for investigating the water quality and the effect of the industrial wastes upon three rivers system in Central New York, USA (1981); testing of Echinostoma liei as a biocontrol agent against Schistosoma mansoni, Theoder-Bilharz Research Institute, (1986 - 1988); the effects of pollutants upon fauna of Lakes Manzala and Maruit ( 1987 - 1988 ); a project for preparing "Egypt Country Study on Biological Diversity", the National Biodiversity unit of Egyptian Environmental Affairs Agency [EEAA] (1993-1994) with UNEP support. Through this project 8 detailed studies on species diversity of 8 taxa of freshwater organisms have been prepared. Moreover, 8 volumes on "Habitat Diversity of Coastal Lagoons and Inland Lakes" have been prepared. Also, he joined a project for studing the Biodiversity at Gulf of Aqaba, under the supervision of Natural Protectorates Department of EEAA (1994-1995).

**NAME: PROF. DR. HELMY M. BISHAI**



**Present Occupation:** Professor Emeritus, Zoology Dept., Cairo University, 1983 -

**Degrees**

Ph.D. King's College, Newcastle Upon Tyne, Durham Univ., U. K., 1954.

- M. Sc. (Zoology), Cairo University, 1951.
- B. Sc. (Hons) Distinction, First Class Honour, Cairo Univ., 1946.

**Field of Research:** Fish Biology, Aquatic Sciences, Aquaculture, Biodiversity.

**Published Articles:** Over 52 papers in international journals.

**Supervision of theses:** More than 20 theses for M.Sc. and Ph.D. in the above fields.

**Teaching Experience**

- Cairo University (from 1946 - now).
- University of Khartoum, Faculty of Science. Senior Lecturer (1958 - 1961). Founded a school of research workers which was the basis of the further research at the "Hydrobiological Research Unit".
- University of Tripoli, Libya, Professor of Marine Biology and Aquatic Sciences (1971 - 1974).
- King Abdel Aziz University, Jeddah, Saudi Arabia (1978 - 1983), Chairman of Medical Biology Department.

**Academic Experience & Scientific Consultation**

- Chairman of Committee for promoting staff members to Professorship in Zoology and Biological Oceanography. Supreme Council of Egyptian Universities (1989 - 1995).
- Vice Chairman Program of Natural Fisheries Resources, Egyptian Academy of Science and Technology (1984 - 1996 ).
- Member of the Committee of National Institute of Fisheries and Oceanography for promoting staff members to assistant professorship and professorship (1985 -1994).
- Chairman of Committee for Exploitation of Marine Resources and Fisheries, South Eastern Egypt, Egyptian Academy of Science and Technology.
- Expert of Marine Aquatic Sciences, Natural Biodiversity Unit ( NBU), Egypt.

**Publications**

- Co-author for many University reference books on Biology, Zoology, etc.
- Translated to Arabic a number of books and articles in scientific magazines as :
  - Animal life - Macdonald Educational Series ( 5 books ).
  - Scientific American, [ Arabic issue - Kuwait ].
- Co-author of "Freshwater Fishes of Egypt" 1997.

**Biography included in the following**

- National Encyclopedia of Eminent Egyptian Personnel, State Information Office, Egypt 2nd edit. 1992.
- Marquis Who's Who in Science and Engineering, 1st edit 1992 / 93.
- Five Thousand Personalities of the World, American Biographical Institute Edit Four, 1994.
- Men of Achievement, 16th Edit, 1995. International Biographical Center, Cambridge, England.

**Membership of Organizations and Societies**

- FAO expert in Fish Biology and Aquaculture.
- "International Directory of Oceanographers" Nat. Acad. Sc. Washington DC 1994.
- World List of Limnologists, 1971.
- Northumberland Natural History Society, U. K.
- Egyptian Zoological Society.
- Zoological Society U. A. R. Co-editor for Egyptian Journal of Zoology.
- Ecological Society of America, (ESA).
- Member of the Society of Egyptian Graduates of British Universities.
- Member of the Egyptian Geographical Society.
- Pan African Fish and Fisheries Association.

**Awards & Certificates**

- Awarded Certificate of appreciation from King Abdel Aziz, University Jeddah, Saudai Arabia 1401 / 1402 H.
- Awarded Certificate of appreciation from Syndicate of Scientific Professions, Egypt as Pioneers in Life Sciences, 1989.
- Awarded MEDAL of Faculty of Science, Cairo University, as one of Pioneers who served the Faculty for 50 years.

# BIOGRAPHY OF THE AUTHORS

## NAME: PROF. DR. ABDALLA MOHAMMED IBRAHIM



**Present Occupation:** Head of Zoology Dept., Faculty of Science, Ain Shams University.

**Degrees**

- Ph. D. on the Biology, Ecology and Biological Control of vector snails, Ain Shams Univ., 1970.
- M. Sc. on the Morphology of certain Freshwater snails of Egypt, Ain Shams Univ., 1965.

**Field of Research:** Biology and Ecology of molluscs and their parasitic helminthes.

**Special Interest:** Environmental Science with emphasis on Biological Control of pests and parasites.

**Published Articles:** Over 70 scientific papers in international and local specialized journals in the above fields.

**Supervision of theses:** Over 40 students for M.Sc. and Ph.D. in the above fields at Ain Shams and other Egyptian Universities and Research Centers.

**Teaching Experience**

- Ain Shams University (from 1970- now) lecturing in Invertebrates, Parasitology & Aquatic Ecology.
- Science Education Center, Ain Shams Univ. as an Expert in Biology Education Development ( 1975-980 ).
- Loaned to the United Arab Emirates Univ., Fac. Sc., Biol. Dept. ( 1980-1984) Participation in various Committees at the Ministry of Education for developing Biology Curricula and implementation of Environmental Education in secondary schools.

**Academic Experience & Scientific Consultation**

- Participation in the annual training program for Ain Shams University lecturers ( 1985 - )
- Participated in the Scientific Committee for the establishment of the Mrs. Mubarak National Museum for Children (1986 - 1990).
- Secretary General of the National Permanent Committee for promotion of Professors in Zoology ( 1989 - 1995 ) and chairman of the Committee (1998 -)
- Supervising the Department of Biological and Physical Sciences, Institute of Environmental Studies and Research., Ain Shams Univ. (1992 - 1997).
- Member in the Committee for the Annual Rewards of Biology and Environment for the Egyptian Academy of Scientific Research and Technology (1993 -).
- Chairman of the Committee for promotion of professors in Medical Malacology at Theodor Bilharz Institute for Research (1994 -1998).
- Member of the Technical Advisory Committee for the Red Sea Coastal and Marine Resource Management Project funded by Global Env. Facility (GEF) of the World Bank (1997 -).
- Chairman of the Egyptian Society for the development of Fisheries Resources and Human Health (1997 -).
- Chairman of the National Permanent Committee for Promoting Staff Member in Zoology (1998-)

**International Symposia and Conferences; more than 15, such as**

- USA (1972), Sweden (1975), W. Germany (1978) and Denmark (1979) for development of Biological and Environmental Education.
- Poland (1977) for the Fourth International Conference on Parasitology.
- UK. & the Netherlands (1987), Turkey & Denmark (1989) for Conservation Education and Wild Life Preservation.
- South Korea (1990), Chile (1996) and Thailand (1998) for the third, fourth and fifth International Conference on Medical and Applied Malacology.
- USA (1997) for visiting Research Centers in Texas and Louisiana, for the Crayfish that invaded Egypt, as a P.I. for a joint research project funded by USAID through the Supreme Council of Universities - Foreign Relations Coordination Unit.